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Can We Step Up Mechanical Department Effectiveness?
Prize Competition Papers

Building Tomorrow's Supervisory Staff:

The Car Department Question:

Meeting the Locomotive Problem:

Electrical Section:

* First prize.
† Second prize.

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RAILWAY
MECHANICAL ENGINEER

Can We Step Up

Mechanical Department Effectiveness?

IN THE following pages are printed the winning papers submitted in the prize competition on the most effective ways of stepping up the efficiency of the mechanical department in the face of the severe conditions posed by the postwar world, which was first announced in the February issue of this magazine. A first prize of $250 and a second prize of $125 were offered for the best papers of not more than 2,000 words on each of three phases of the general theme, one pertaining to motive power, one to the car department, and the third to the general problems of supervision. In each case the two prize-winning papers are accompanied by others which received the next three highest ratings.

Several facts and impressions concerning the entries on these three phases of departmental effectiveness are worthy of consideration:

The contributors come from a wide range of backgrounds, duties and responsibilities. Some are supervisors; some are from the ranks.

One of the first-prize winners is a college student.

No "great" or inspired solutions of the problems discussed were forthcoming.

Recognition that all is not well in the field of employee relations crops up in all three sets of papers.

The need of more education and special training for all grades is repeatedly stated, by men in the ranks as well as by men in supervisory positions.

That no "great" or inspired solutions were forthcoming is the outcome of the very nature of the problems as they are diagnosed by the entrants. There *are* no such solutions. In some cases, at least, the diagnoses are not entirely complete. But, in spite of that, the kind of remedies suggested, involving in some cases changes of policy on the part of management, are, generally speaking, practicable and capable of effecting improvements in mechanical-department operations.

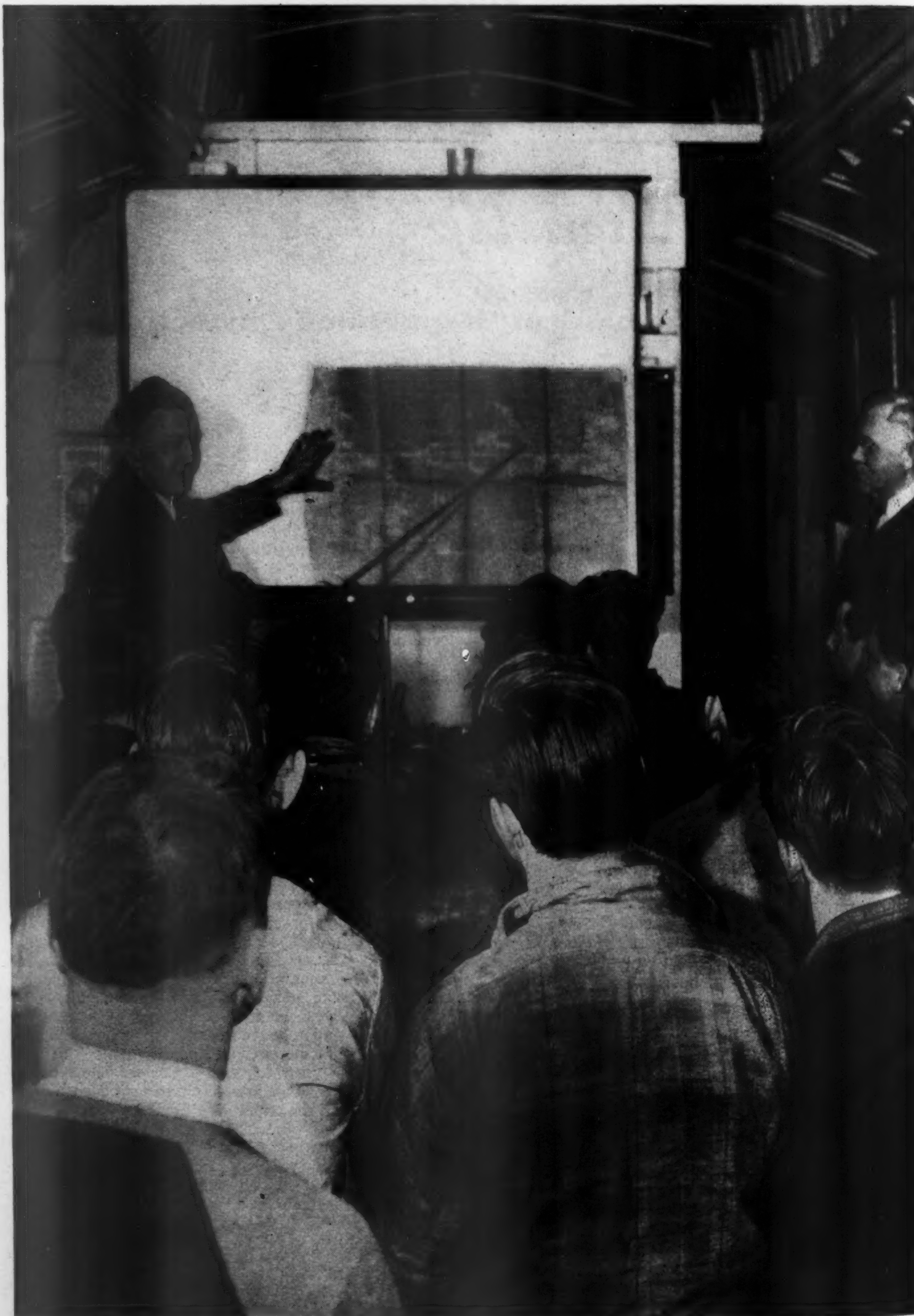
It is the winner of the first-prize on the problems of motive-power utilization and maintenance who is a college student—a midshipman at Annapolis. In submitting his paper he disavowed any practical experience, admitting frankly that his knowledge of the field came from reading its current literature, including, no doubt, the proceedings of some of its associations. This means that the suggestions of this young man have all been put to the test of practical application somewhere. What better means of elevating the general standard of performance than by the universal application of current improvements in practice? By and large, such is the material to be found in the sources named.

That the most difficult problems pertaining to the car department arise from the shortage of freight cars is clearly recognized by the authors of the contributions on that department. Obviously, there is just one solution to the lack of cars—the acquirement of more cars in adequate quantities. The accomplishment of this end, being beyond the power of our contributors, they have discussed measures of lesser effectiveness but by no means lacking in possibilities of practical results. One of these most frequently repeated is the improvement of protection against weather at repair tracks.

The difficulties of today are the outcome of yesterday's errors of policy and mistakes of procedure. The only hope of correction lies in the painstaking search for an understanding of these errors and in the possession of enough imagination so that measures applied today will be adaptable to the new conditions of tomorrow.

For instance, there is a general appreciation of the need of more employee training—particularly, of the training of foremen to deal with personnel matters. But this is neither a complete diagnosis of the nature of present personnel problems nor an adequate solution of the employee relations in the mechanical department. The relations between employees and management, on the railroads just as in other industries, are dominated by a struggle for power in which the contentions of neither party give a clue to the real nature of the controversy. The solution lies in the realm of policy and both management and the employee organizations will find it necessary to effect a change of purpose before there can be much hope of a reestablished basis of cooperation in the interest of the public who use the railroads.

Whether or not our readers find within these pages the ideal answers to the problems which are now troubling them, they cannot fail to find a stimulus to their own thinking. A suggestion—the beginning of an idea—is often better than a ready-made answer.



Courtesy of the New York, New Haven & Hartford

Building Tomorrow's Supervisory Staff . . .

Q. More than ever before intense operations under war conditions threw into striking relief the strategic importance of men in supervisory positions in building morale and securing greater efficiency from the forces under their direction. Incidentally, the same thing was true of all industry. If the railroads are successfully to meet the severe competition with which they are now threatened, every possible effort should be made to secure and maintain a high degree of morale and efficient operation. What can be done better to equip and strengthen the hands of men in supervisory positions to enable them to function more effectively?

First prize:
E. P. Gangewere, superintendent motive power and rolling stock, Reading, Reading, Pa.

Second prize:
A. N. Campbell, assistant chief draftsman, Canadian National, Montreal, Que.

Honorable mention:
L. E. Grant, engineer of tests, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee 3, Wis.

G. E. Green, assistant night enginehouse foreman, New York Central, Sharonville, Ohio.

J. L. Ferrel, air brake mechanic, Missouri Pacific.

Supervisor Needs Guiding Hand

First Prize

By E. P. Gangewere*

The last 10 years have seen major advances in tools and machinery in addition to which personnel problems have come to the front — Supervisors now have to deal with matters in which they are untrained

INDUSTRIAL activity, as we are today experiencing it, calls for the maximum coordination of human effort to make any enterprise successful. Railroad mechanical departments are a vital phase of modern industry. In their operation, coordination depends upon the overall efficiency of worker and supervisor. The mechanical departments in railroad transportation are charged with the responsibilities of providing economical, failure-free motive power and rolling stock, in large enough quantity adequately to handle all traffic offered. Now, as always, qualified, capable leadership equipped with the tools of good judgment and the "know how," to get things done, forms the basis of reliable and dependable performance. As the personnel problems have increased, and technical advances in tools and machinery have outmoded in some instances the practice of only 10 years ago, it is essential that those who are entrusted with the leadership of even a few employees should receive the guiding hand of major supervision, in executing their daily tasks. The suggestions outlined herein are those materially substantiated by practical experience, and have been found helpful in strengthening the hands of those who supervise.

Basic Need Is Apprentice System

A smooth working machine tool is the result of many hours of design and shop work. Similarly a good supervisor should, by present day standards, be the product of a moderate period of training for his position. This being fundamental, an apprentice system of the highest type is the starting point for bringing out the latent qualifications of an employee, who some day will be one of a number selected for promotion. This apprentice system should be in the well-trained hands of a capable instructor. This instructor, by the very nature of his tasks, has the power to formulate lines of logical reasoning in the minds of younger men; and to instil in their daily work, the qualities of obedience, skill, honesty and personal integrity, so necessary to their individual welfare.

The apprentice schedule should comprise a well-rounded training in each craft, within the normal prescribed time limit. Periodical tests of a practical nature to determine the progress of each trainee are important. These provide a means for judging the capabilities of each individual for certain tasks in the future. To enliven the apprentice system department heads, such as general foreman, shop superintendent, and the superintendent of motive power, may at intervals address the class groups and provide the added initiative which a good capable apprentice instructor needs and has the right to expect.

Make Labor Problems Clear To Supervision

A clear and concise picture of labor relations is all important to the supervisor of today. Existing agreements between the company and its labor representatives should be thoroughly explained to each supervisor. Misunderstandings frequently arise through improper interpretations of existing rules, and the efforts of supervision can be materially improved by personnel officers freely offering their advice, along with the guiding hand of their intimate knowledge of labor matters imparting unbiased decisions to the foremen or supervisors, whose efforts are in the main directed to the daily practical tasks at hand. General supervisors can be adequately guided through weekly meetings by department heads, where a common ground for solving personnel matters should be developed. At this time the cardinal principle of sincerity in all such matters should be stressed, and the ability to judge human nature, as it exists in the shop, should permeate the discussions. It is through such advice from the departmental supervisors, that the foreman can obtain, quite often, the answer to many of his perplexing problems, since the general supervision has an overall picture of operations that frequently benefits those who are of necessity confined to more detailed work.

It is axiomatic, that clear and concise instructions form the ground work for definite results. The major supervisor or departmental officer should remove doubt from any of his orders, by making clear cut decisions. This provides for a firm understanding by the subordinate officer, of action to be taken, and fortifies his position, as he can then govern his actions with the inward feeling of properly carrying out the instructions received. At this point, the asking of questions by supervisors, for clearer understanding, should receive due consideration from those leading the discussion. It should be realized that a difference in viewpoint is a fundamental aspect of human nature, and adjusting oneself to the other fellow's viewpoint, brings a fusion of results that is not often achieved otherwise. Railroad operation is intensely practical, and as such, requires clear and concise language for direct action. At weekly meetings by departmental supervisors, a few minutes can well be spared, in covering the programs of work to be executed, and a definite program outlined for production to be secured in the days to follow.

Is There Personal Incentive?

Personal incentive is another creditable attribute of human nature which is ever present. This feature should not be overlooked in promotion programs. Lines of promotion, by actual practice, should illustrate that inherent ability, willingness to cooperate, good judgment and similar characteristics are freely considered when men are moved up the ladder. A step-up calls for a personal talk to the promoted man by the department head, in order

* Superintendent motive power and rolling stock, Reading Company.

that the individual so selected may have a firm understanding of his responsibilities and the duties of his position. This man-to-man talk gives the junior supervisor the confidence which he needs in assuming increased duties. At this time he should be given a clear picture of his company's mechanical policy, and this policy should be stressed as one to be followed in all major decisions. All supervision, for example, needs such general information as material costs, and unit costs of work performed in the mechanical department. This information gives each officer a chance to judge his own performance and take stock account of his operations.

It is felt that a periodical review of the mechanical department's performance with supervision is very helpful. For example, a foreman in the locomotive back shop and car shop should know what the performance of equipment is on line-of-road. In this way only can he better understand operating problems, as related to strictly repair problems; similarly the outside repair supervisor should know what transpires in the back shops. This procedure has been found very helpful in building up supervisory morale. A further strengthening of this relationship is achieved by having made to the large shops by men from the outside engine houses, etc., and vice versa.

Review Performance At Staff Meetings

As a part of the weekly staff meetings of the senior mechanical officer or his designated representative, the above features may be incorporated. There should also be included at this time a review of weekly car and engine failures, in order that causes thereof may be analyzed and proper corrective measures planned. A discussion of Interstate Commerce Commission reports, interpretation of car interchange rules, safety regulations, etc., is very helpful. Each supervisor should be encouraged to make pocket note book records of important discussions and events, so that he may round out and increase his general knowledge of mechanical department matters.

Railroad maintenance of equipment involves a diversification of knowledge seldom required in other fields of mechanical endeavor. With such a varied type of repair work, in handling locomotives, cars, cranes, car dumpers, etc., it is essential for the mechanical department supervision to be on the alert at all times for unusual conditions which may cause failures, delays, or accidents. This fact should be a topic for frequent discussion with local supervision by senior officers, who should cite specific examples of cases where delays were avoided by keen inspections, as well as by alertness to unusual conditions in cars and locomotives. The ability to analyze enginemen's work reports, to coordinate locomotive and car repair schedules is most helpful, and should form a part of the supervisor's fundamental knowledge. Quite often the use of a significant occurrence as recorded in an I. C. C. report or newspaper clipping and brought to the attention of an individual or group, will serve to bring home the points at issue.

Current Trade Literature Helpful

One of the assets of every mechanical department is the supply of current magazines which are received, dealing with railroad and allied industrial practices and problems. It is indeed a grave mistake not to pass along to subordinate supervision these periodicals as they are received, in order to widen the knowledge of each recipient. A number of worthwhile improvements have been made, merely through the information gleaned by a foreman or gang leader from mechanical magazines. This procedure aids beyond monetary value in developing new ideas, and serves to focus attention on the individual problems that have frequently been experienced, and which the supervisor may be grateful to know; have been successfully solved by some one in a similar position. The forwarding and listing of important articles in contemporary periodicals to various foremen, master mechanics and department heads had been found by the writer to be extremely beneficial in developing individual initiative.

An equitable distribution of individual responsibilities is helpful in strengthening supervisory bonds. Should the inability of one officer to handle his current problems be passed along by his superior to another officer, as a matter of continual practice, there may be an eventual loss in overall supervisory efficiency. Practical and

An efficient apprentice system the beginning of well-rounded supervision

sound advice to each man in charge of a phase of mechanical work is most helpful at times, in clearing up current personal problems of this nature. A supervisor, by his very nature, appreciates personal contact from a senior officer, for this is an integral part of a well organized and properly guided operation. It is this contact that cements the relationship of management to general supervision. A fundamental knowledge of the tasks being supervised is all important, and he who leads makes a grave mistake if he thinks that those who work for him are not capable of discerning his shortcomings, when it comes to the practical handling of any job.

Recognition for Good Work

Praise for work, or for a well-planned job forms a very important stone in the arch of supervisory efficiency. The distribution of this praise should be commensurate with the individual results obtained by the recipient. It should be given in the light of well rounded experience, and a mature understanding of human nature. Conversely, criticism should be, in its entirety, constructive. Certainly the well balanced supervisor should understand the benefit of criticism properly directed. It is the judicious use of each, praise and criticism, that quite often provides that added incentive for doing not only what is asked or requested but also performing that which in one's mind best serves the company's interests, and produces results over those ordinarily anticipated.

Of the suggestions previously enumerated, it seems to the writer that the cardinal principle most worthy of consideration in guiding the actions of supervision, is exemplary leadership. The old adage—"Actions speak louder than words," has its full import today, as always before. Departmental officers and senior personnel, by displaying those attributes which by their very nature command respect, will provide the proper mirror for reflection in the hands of subordinate supervision. The social contacts made in booster clubs, a part of the morale-improving units existing on a number of railroads, serve to accentaute the outlets for exemplary leadership. The hands of supervisors can be materially strengthened by the sort of generalship which leads by personal example, and commands obedience by exemplary action.

"Give Us The Tools..."

Second Prize

By A. N. Campbell*

Railroads must set higher standards of efficiency than ever before and this can be attained only by selecting and training supervisors with greater care than in the past

"Give us the tools and we will finish the job."

A railroad car-department supervisor's tools are his workmen, his organization. By proper selection and training this tool can be made efficient and the supervisor, himself, as he passes from the blade to the handle in the training which conditions the tool, can place in the hands of railway management an instrument which will help maintain for American railroads their rightful place in the transportation field.

It has been said that the foreman is the keystone of the production arch. In the past, little attention was paid to selection and training of railroad car-department supervisors or individual members of the car-department organization. This may have been due to the limited qualifications to be found in men which could be drawn into the crafts as well as to the limited training considered necessary to fit men for the carman's trade in particular. When construction was largely wood, speed and quality of service were lower. Therefore, "wood-butchers" and car tappers were not necessarily highly skilled or qualified specialists. Railroads were not then so cognizant of the fact that certain particular qualifications in supervisors were important, and therefore, seniority was often the governing factor in their selection from a poorly trained field.

The ideal situation in any industry includes an existing staff of competent experienced supervisors, with a reservoir of potential material behind them in an efficient and well-trained organization, which includes several individuals capable of replacing each supervisor and susceptible to further training and advancement.

The railroad car department, today, has no place for wood-butchers, "car toads," and "wheel tappers." Highly skilled specialists are essential. Diversified new materials must be precision fit and molded into the modern car structure to provide the appearance and strength necessary to meet present-day requirements. A high degree of intelligence is required of an efficient car inspector, the modern counterpart of the wheel tapper. He must master the complexities of interchange rules, safety appliances, explosive and perishable commodity regulations and the various other requirements necessary to the safe operation and free interchange of equipment between railroads. He must have a working knowledge of the various intricate mechanisms of which present-day car equipment is composed in order that he may quickly and intelligently recognize, diagnose, and repair failures or potential faillures before their development can cause trouble or interference with schedules.

In the mechanical department of a railroad a definite program of apprentice training must be set up, including a reliable record system which will reflect accurately the qualifications, development, potentialities, and characteristics of each individual so that selection of supervisory material from the most qualified may be made intelligently.

The first step in organizing such a system consists of

* Assistant chief draftsman, Canadian National, Montreal, Que.

MERIT RATING CHART

Date ________________ Name ____________________ Clock No. ________

Rating for period from ______________ to __________ Craft __________

Department ____________________________ Location ____________________

Type of work ____

PUT CROSS IN SECTION WHICH MOST ACCURATELY DESCRIBES EMPLOYEE. TOTAL

Accuracy of Production	Careless 0	Average 6	Good 8	Excellent 11	
Care of Working Space	Careless 0	Unconcerned 3	Interested 4	Orderly 5	
Handling of Equipment	Careless 0	Indifferent 3	Dependable 4	Very careful 5	
Speed of Production	Slow 0	Moderate 6	Fast 8	Exceptional 11	
Use of Working Time	Loafs 0	Active 3	Industrious 4	Conscientious 5	
Use of Materials	Wasteful 0	Unconcerned 3	Economical 4	Saving 5	
Ability to Learn	Poor 0	Average 2	Fast 3	Exceptional 4	
Acceptance of Responsibility	Evades it 0	Indifferent 1	Accepts it 4	Seeks it 6	
Initiative	Timid 0	Cautious 3	Confident 4	Aggressive 7	
Ability to Direct Work	Unwilling 0	Indifferent 1	Interested 3	Capable 4	
Attendance Punctuality	Poor 0	Average 4	Good 7	Excellent 9	
Attitude Toward Job	Dissatisfied 0	Indifferent 2	Satisfied 4	Enthusiastic 5	
Attitude Toward Workers	Disagreeable 0	Indifferent 3	Agreeable 4	Cooperative 5	
Attitude Toward Safety	Contemptuous 0	Unconcerned 5	Inconsistent 6	Careful 7	
Observance of Safety Rules	Disregards 0	Occasionally 3	Usually 4	Always 6	
Appearance	Careless 0	Average 2	Good 4	Excellent 5	
TOTAL					

SPECIAL REMARKS: ____

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Rated by: (Title) Approved by (Supt.)

REMARKS APPLYING TO APPRENTICES ONLY: ________________________________

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Apprentice Supervisor.

establishing qualifications for candidates for apprenticeship uninfluenced by "pull," relationship to present employees, or any considerations other than ability to meet standards set up. It is realized, of course, that actually only a small percentage of employees will be ultimately required as supervisors. However, the greater the reservoir of potential material available, the more efficient should be the future supervisors chosen and, therefore, the training will not be lost on the remainder.

Minimum qualifications for an apprentice candidate should be confirmed by written, physical, and oral examinations held under the supervision of a responsible officer and should include the following:

1—Intelligence and educational standards sufficiently high to insure that the candidate is, or can become, proficient in elementary mathematics; in mechanical drawing to the minimum extent of ability to read drawings, make and dimension sketches; ability to understand from text principles of construction and operation of mechanisms.

2—Physical condition, such as to enable candidate to adequately perform all work in the trade without difficulty and to be relied upon for regularity. Examination of senses and physical condition will, of course, be made by a physician in accordance with railroad physical standards.

3—Agreeable and cooperative personality.

4—Appearance such as to make a good first impression, exhibit self-confidence, good physique, etc., clear and forceful speech.

5—Age limits should be 18 years minimum, 23 years maximum, with rate of pay sufficient to attract men of this age, increasing by steps until at the end of a term of apprenticeship journeyman's rate is reached. Many men do not realize the importance of getting the most out of training at an earlier age.

Make Future Opportunities Clear

In employing apprentices, officers should endeavor to select without exceptions a candidate who has qualifications that will enable him, with training, to advance far beyond the duties of a mechanic. In order to procure applications, it will be necessary to publicize locally the fact that this training is not merely preparation for attainment of journeyman's pay, but leads to mechanical department supervisory positions.

Apprentice training should begin with a recognized period of probation, during which those showing ineptiture can be weeded out. It must always be kept in mind that an apprentice in his first six months should not be considered as such, but as a potential charge hand or inspector subject to seniority clauses of agreements with labor organizations. Twenty years hence the onus may lie with the employer to prove he is not suitable.

There should be two concurrent phases of training—on-the-job and school-room training. On-the-job training should be supervised by a competent, interested shop instructor whose duties include moving the apprentice about at appropriate periods from job to job in the craft in order to provide all-around thorough experience. Sufficient interest should be taken to see that the apprentice is occasionally entrusted with some responsibility. This is absolutely essential to the sustenance of interest on the part of the candidates of the qualifications required. On-the-job training should entail moving about between several shops, coach yards, and repair tracks, even if at some hardship to the candidate. Conditions and practices will vary and, if some inconvenience is entailed in this procedure, it should only serve to determine if the apprentice has the necessary interest in his future to accept it.

Classroom should be practical as well as theoretical. Mathematics should include, for example, determination of proportions of levers for air brakes on cars in the shops, etc. Mechanical drawing should include study of blueprints covering alterations to cars in the shop, sketches of new jigs actually required, tracing drawings made up in the drawing office, etc. In this way useful work may be accomplished while study is activated by the best type of stimulus. Objective study of the Association of American Railroads rules of interchange, safety appliance regulations, loading rules, etc., may be arranged by allowing the apprentice to execute actual bills to cover work done on foreign cars.

To such a system, periodic reports on progress of individuals is essential. A system of evaluating the apprentice's development should be worked out which will reduce to a minimum the area of arbitrary personal judgment by developing impartial and objective units for measurement of intangible qualities. A report form is shown in an accompanying chart. This should be filled out at each step in the training by the supervisor most intimately concerned with the man personally and should be attached to employee's permanent files.

By the end of the candidate's apprenticeship, it should be fairly evident, if reports have been properly executed, whether or not he is worth while considering for supervisory material and further training, or whether he should be considered to have qualified as a journeyman with little prospects for promotion. Reports on his progress should be filed yearly, at least until it has been established that he is not developing further possibilities. This will not take much of his supervisor's time and it will keep his record up to date for consideration on short notice. Men whose reports have been favorable should be so advised and it should be made known to them that they are considered as candidates for certain positions. When others are chosen first, the reason should be made known to them. There will often occur a considerable period of time after the date of graduation before a position to which the candidate is suited opens up. During this time it will be necessary to sustain the man's interest by giving him some responsibilities from time to time.

All this is predicated upon establishment of rates of pay for any supervisory position commensurate with the duties and responsibilities associated therewith which should be sufficietly above that of those supervised to make it worthwhile.

Provide Supervisory Experience

At this stage of the candidate's career he should have had some supervisory experience as a result of temporary service in positions of responsibility which he may have been given opportunity to fill through sickness of the incumbent or which may have arisen temporarily.

Now, let us consider some of the qualifications a present-day supervisor should possess, as compared to accepted qualifications of supervisors in the railroad industry in the past. Fifty years ago, choice of a man's career was made for him while he was still a boy. His experience, training, and knowledge was limited to the particular branch of the trade in which he had worked a lifetime and, if he was finally chosen as a supervisory, it was usually on account of his seniority, his proficiency, or skill in the manual process. He supervised, largely by example, men he had known and worked with for years.

Most satisfactory results are now achieved by a supervisor who has charge of a strange band of workers of various specialized skills impossible of mastery by one individual. He has no personal ties with his men and his qualifications should include certain attributes apart from his technical training which enables him to organize and secure cooperation, more important than complete mastery of the skills of the men supervised. Primarily, he should be ambitious, a builder for the sake of building,

a man willing to pay the price for leadership. He should be emotionally stable; abnormal or sick people cannot give good leadership. He should live like a leader. He must be intelligent with a sense of purpose and common sense. He should have physical and nervous energy in abundance. He should be free from arrogance, insincerity and jealousy, a sign of conscious weakness which will interfere with his development of others. He should not be one of those men who fear to raise the status of others to their own, but rather consider themselves constituted as an arbitrary ruler of those over whom they have authority.

The minor supervisor should be moved frequently to different positions. If possible, his career should begin at a large shop where he may act as assistant foreman under an experienced and qualified foreman. Later, he might be sent to a smaller, less important point as foreman to develop self reliance, ingenuity, and resourcefulness. Here, also, he will find the necessity for cooperating with other departments. This will fit him, if he develops satisfactorily, for further responsibility as foreman at a larger point. and so on.

Throughout this article no mention has been made of the technical graduate. Obviously, educational qualifications can be easily met by this type of candidate. However, in so far as training and selection for supervision is concerned, a man with a university education must accept apprenticeship on equal footing with the non-technical man. If he is of the right caliber, he will, of course, progress with greater rapidity commensurate with his educational advantages.

It has been said that the greatest undeveloped resources of American railroads lies in their personnel. Unfortunately, railways were slow to adopt the practices of other industries in selection and training of employees and supervisors. Other industries have found that this is profitable. The same should hold true for railroads. In the years to come railways must fight to increase their efficiency of operation to a degree never before necessary in order successfully to meet competition from other carriers. They must obtain higher standards of ability and loyalty on the part of employees and supervisors far beyond anything expected in the past. Supervisors must be properly selected and trained. They must be provided with the tools to do the job efficiently.

Supervisory Problem Has Many Angles

A discussion of the question in a group of three papers that will throw new light on specific points

Somewhere in practically every paper submitted in this contest, regardless of which of the three categories it may have been in, the authors discussed the question of management, supervision and labor in greater or less detail, proving that without a sound policy in this field the solution of all other problems becomes more difficult. The three papers presented in this group offer valuable sidelights on points that the prize winners covered.

Rebuild Your Supervisory Staff Now

Railroad organizations are growing older year by year and move must be made to bring in new men

By George E. Greene

Assistant Enginehouse Foreman, New York Central

The efficiency of any organization is dependent upon two things, first, the training and skill of the mechanics who constitute the basic structure of the maintenance forces; and second, the degree of modernization of the plant in regard to machinery and facilities. By directing our attention toward these two fundamental factors, (that is —by correcting the defects existing in our training program as by improving plant facilities) we *can* strengthen the hands of supervisors and thus attain more efficient operation.

One of the most apparent mistakes which has existed over a period of years and which became glaringly evident during the war, is the failure of railroad mechanical departments to provide a sufficient number of trained mechanics to do the actual work. A supervisor who must personally solve all of the maintenance problems which present themselves in the daily routine, finds it impossible efficiently to supervise his men, schedule work, dispatch locomotives and still keep closely in contact with the plant as a whole. Conditions existed during the war which amply illustrate this point—air defects, special device defects, and all other mechanical defects which could have been diagnosed and repaired, were there properly trained personnel to do it, fell upon the shoulders of the supervisor. At numerous plants, during wartime operation, one-half of the mechanics engaged in running repair maintenance were set-up helpers or accelerated course appentices. Due to the exercise of seniority the bulk of these men were finally settled on the night shifts. This made the organization of maintenance crews around a few high-

ly trained men as a nucleus impossible, and the general maintenance as well as the repair of defects suffered in consequence. How many failures and delays could be attributed to poor inspection or improper maintenance—and how many of these same failures and delays could be traced directly to a man working as a mechanic who failed to recognize a defect and properly repair it?

Organizations Do Grow Old

An inadequate number of well trained efficient mechanics is a direct result of several factors. The general apathy of railroad mechanical departments in properly training apprentice mechanics of the various shop crafts is one. The method of selecting attractive applicants for apprenticeship is another. Our failure to provide enough apprentices to replace men who are retiring is still another. At one point on our system the average age of mechanics is 50.3 years. Upon examination of this fact no great concern need be shown as these men still have an average of 14.7 years of work before attaining the retirement age of 65. However, and this fact is significant, in this group of mechanics, 43 per cent are 55 years of age or older, and will reach retirement age in 10 years or less. By maintaining the present ratio of apprentices to mechanics we will be unable to replace these men.

How can these problems be overcome? Railroad management should establish a definite apprentice training program, adequately supervised, and closely followed by the officers of the mechanical departments. Complete technical information in the form of instruction pamphlets, published by the railroad supply companies, and copies of the various mechanical regulations of the respective railroads, should be placed in the hands of each apprentice. At the completion of each phase of the training program the apprentice should be given a thorough examination in order to determine his progress. By successfully carrying out a program of this type, railroad management would prove that it is vitally interested in the proper maintenance of its mechanical equipment and rolling stock. It also follows, that a course of this kind would prove to be an investment which would guarantee handsome dividends in the future to railroad mechanical departments. As each new type of motive power comes off the drawing boards it becomes more complex and more expensive. The day of successful operation with "hammer and chisel" mechanics is fast drawing to a close. There is no place in modern locomotive maintenance for mechanics of this type.

Obsolete Methods of Selecting Men

Our method of selecting apprentices dates back to the days of wood burners and link and pin couplers. We choose an apprentice because his father or some relative recommends him. He is then given an examination covering sixth grade arithmetic and certain aspects of mechanical drawing. If the applicant successfully passes this examination, he becomes an apprentice mechanic. This method is not only haphazard but the railroad company cannot be assured in any way that the person selected will become a good mechanic or a good social worker. There are personnel tests, in use today by the Army, Navy, and private industry, which clearly indicate such things as mechanical aptitudes, basic intelligence and initiative.

In the coming years severe competition in the field of transportation among inland waterways, trucking firms, airlines and railroads may be expected. If the railroads are to improve, or even maintain their present position in this field, we must have plant facilities which compare favorably with those of our competitors. Let us examine the facilities of the trucking and air transport companies and draw a comparison with the average plant in use by the railroads today. Both of these competitors are comparatively new industries and both are employing new tools and new methods of repair in their daily maintenance. They have the advantage of a great parts interchange reservoir built and maintained by the automobile and aeroplane manufacturers. Visit any airport and you shall see modern hangars, recently built, clean, well lighted and equipped with the best tools and machinery. Trucks, enroute, may stop at any number of service stations owned, equipped and operated by private individuals who are competing for the patronage of the trucking lines. As a rule, the plants used by the railroads for the service and repair of locomotives are a far cry from those of our competitors. They are usually poorly lighted, badly ventilated and designed to meet the transportation demands of thirty or forty years ago. Of course, modernization programs are in motion, but are these plants laid out with an eye to future conditions and problems or merely attempts to bring some degree of modernization to antiquated plants? For example, will the improvements being made today in enginehouses handling steam power be adaptable to newer types of motive power? They should be, for by referring to orders placed for new locomotives we find that at least 95 per cent of these orders specify Diesel electrics. In the near future our existing plants will be required to maintain this equipment. Modernization of plant facilities must be made with careful consideration being given to this fact. Drop-pit tables must be able to handle a six-wheel truck. Power jacks with a higher lift than those generally in use in enginehouses should be purchased when renewing existing equipment. Any addition to present buildings should be designed in such a manner that they might easily be converted into Diesel repair shops. Lathes with sufficient swing and distance between centers to permit traction motor armatures to be turned should be substituted for present equipment. Small hand power tools, especially electrically operated ones should come into more general use. Our present cumbersome system of distribution of replacement parts must be overhauled. We would feel very foolish if we were to allow a shortage of material and parts to make inroad on the record of availability of Diesel locomotives as we have in the past with steam power.

Modern Facilities Are Easily Converted

These are but a few of the things that can be done. With proper consideration given tools and plant facilities now, we shall be able to convert our steam enginehouses into Diesel repair and maintenance shops at no great additional expense. The finished product will not be, as in the case of many present day enginehouses, a 1900 model, which, like Topsy, "Just growed", but a modern, efficiently designed plant, equipped with facilities to handle successfully, the maintenance problems of coming years.

If we were drilling a piece of steel and our drill bit was not cutting, we would sharpen it. If we were turning a bushing in a lathe with a dull cutting tool, we would sharpen it. These are the tools with which we do a job. Men and facilities are the tools a supervisor employs to do his job. Dull, blunt tools reduce the potential effectiveness of all supervisors. Why should we be satisfied with 75 per cent effectiveness when it is within our power to attain 100 per cent? Most of these suggestions can be installed in present mechanical department organizations without increasing budget allotments. Some of them will require a small additional outlay of money.

What Should A Supervisor Be?

First, he must be a practical psychologist—Then he must be fair—A lot of employee training is needed—Preferred jobs need differential rates

By J. L. Ferrel
Air man, Missouri Pacific, Wichita, Kansas

This article is the opinion of a man not a supervisor as to what a man in a supervisory position should be in order to build morale and increase efficiency. It also presents a non-supervisory opinion of what a company behind a supervisor can do to stimulate interest of employees and promote efficiency.

Personal Qualities of Supervisors

The men chosen for foremen should be no more than of middle age as men of this age are more progressive and alert than men who are older. They are, therefore, in search of new ideas and new methods for progress where an older man will be satisfied with conditions as they are. Furthermore, a young man will be more alert in promoting safety among the employees. Every supervisor and employee alike should and must be safety minded at all times. In order to keep away from needless injury and suffering to the individual as well as the man hours lost to the company.

Injury and accidents are one of the worst assets a company can have.

The supervisor should supervise safety just as diligently as he performs his other duties.

The supervisor should have an outstanding personality, an ability to understand human nature in order to get the best efficiency from employees. Nearly every man has an individual disposition, which the supervisor has to know, study and understand to win the confidence of the man. The supervisor must be a diplomat as well as supervisor.

Most men are far more efficient and safety minded if they are in a good mood (let's say) than when in a bad mood.

There are men who have trouble at home, and they come to work all upset and nervous, their minds not at all on the work they are doing. Then along comes the supervisor and they get more nervous wondering what is up and are liable to hurt themselves or someone nearby. A good supervisor can find what is troubling the man and possibly help him correct it, whereby he will be more efficient and a better workman.

I do not mean by the foregoing that a supervisor should bow to an employee. There is no supervisor who can do that and be an efficient supervisor. He must be very firm and businesslike with employees to have their respect. He should be reliable, and of good sound judgment, and have a practical mechanical knowledge of the work he is supervising and how to get the efficiency desired of each man.

If the supervisor will see that each man gets an equal square deal or, as near as practicable, wins each man's confidence, and support through cooperation with his men, he will have their loyalty and full support at his command.

Then the only strengthening he will need will be what the company for whom he works wishes to equip him with. There are many things a company can do to help the supervisor do a better job and many ways they can build the morale and increase the efficiency of the employees, secure greater production and a better working condition.

Vocational Education and Morale

A good way to build morale among employees would be to stimulate more interest among them. For instance, some sort of merit system whereby an employee could be commended for a good job, or given credit for his ideas if they warrant it. This will help stimulate an interest in the men and they will start looking for new ideas and ways to increase production. They will feel more as though they are a part of the company than just an employee, as most of them feel now. Each employee should feel that he has the most important job in his department and that he has a responsibility in performing that job.

A vocational education program would also increase the morale of employees by giving them an opportunity to qualify themselves better for some particular job such as inspectors, record writers, or air-brake workers. During the late war years a number of new employees have been added to the railroad forces. Some have had very little experience. Most all of these employees would benefit by such a program.

I sometimes wonder if some of the serious railroad accidents of the past few years are not largely due to inexperience, or incompetent inspection?

Differential Rates for Preferred Jobs

If the railroads would pay a differential rate to employees who hold such preferred jobs such as car inspectors, safety-appliance men, record writers, and air-brake men, they would get a more experienced and efficient force on these jobs. The older more experienced men are not taking the interest in the responsibility for the same wages.

Some roads do not require the inspection force to stand rules examination, and do not pay a differential rate to these employees. This method is not in the best interest of safety, to the company or the public. All of the above jobs should require an examination on interchange, safety-appliance, and loading rules, if the company expects to get the best efficiency from the forces.

Another item that would increase efficiency and production a great deal and build morale among employees also, would be for the railroads to build adequate shelter under which to repair cars where the employees would be shielded from bad weather. Bad weather slows production on most repair tracks about forty per cent, especially during extremely cold or wet weather.

The railroads, like all other industry, must become more modern if they are to meet the sharp competition ahead. Modern tools, and modern equipment are not enough. They must have a modern, well-trained and satisfied mechanical force. Safeguard the equipment and promote good will between the public and the railroad by boosting for the railroad and securing business to be

moved by it. If an employee is satisfied, he will be a good booster for his road. But first, he has got to be sold on the idea that he has the safest and best railroad there is.

The Worth of the Car Inspector

A car inspector can cost a company a lot of money by the wrong classification of cars, causing loss or damage claim to freight, or by overlooking something that will cause a serious wreck resulting in great loss of freight and equipment, or loss of life if passengers are involved.

This is why an inspector should be an alert, well-trained, and competent employee in preference to an inexperienced one. I do not think the importance of training employees can be stressed too much with the constant new changes that are being made in equipment today and the days yet to come.

The airbrake problem is another that is becoming more complicated each year with the growing weight of cars and faster train of heavier tonnage than of previous years.

The supervisor should hold meetings with his employees and inform them of the problems with which he is confronted and how he intends to meet them and ask for the help and support of everyone to reach the goal. He should also ask for suggestions or ideas that might speed the operation and increase the efficiency. This will produce a higher morale among the employees.

The Missouri Pacific was proclaimed by our late president, L. W. Baldwin, as "a service institution." It is the aim of all supervisors and employees alike to make the Missouri Pacific a better "service institution" in the years to come.

Foremen Deserve Good Pay for Their Job

If railroads would see that their supervisors are treated as well as the men their morale would be raised

By Leland F. Grant

Engineer of Tests, Chicago, Milwaukee, St. Paul & Pacific

Something is amiss with the present system of railroad supervision and an opportunity for discussion and constructive criticism will undoubtedly bring out some concrete suggestions for remedying the situation. It is hoped that by focusing the light of discussion on this problem, both railroad management and the Brotherhoods may be led to see the handwriting on the wall. Methods for correcting the present unsatisfactory conditions must be found if railroad management desires to maintain in the future the same degree of loyalty from the supervision that it has had in such rich measure in the past.

There was a time when one of the assets of a successful foreman was an ability to curse fluently and expressively and to back up such remarks with a pair of vigorous fists, if necessary. The days of this type of foreman are past and happily so, yet the basic problems which the supervisors face remain the same because human nature has not changed. To obtain satisfactory results the foreman must gain the respect and cooperation of his men; yet he must maintain discipline in the face of the present day independent attitude of workmen which is encouraged by powerful unions. Sometimes it appears that workmen no longer have the pride in good craftsmanship they formerly had and certainly not many of them can be classed as "eager-beavers" for work. Faced with a job they dislike they may either refuse to do it or plead illness and go home for the day with no regard for the effect of their action on the foreman's schedule or position. Yet when the foreman tries to protect himself by disciplining such an employee the union rises in indignation and claims that the supervisor is persecuting the individual. Even the most aggressive and conscientious foreman will eventually become disgusted with the browbeating he is subjected to by union representatives when he makes an issue of any kind of disciplinary action and will not subject himself to it except for the most flagrant cases. The unions and railroad management are both responsible for this condition and must work out means for correcting it. The labor organizations on one hand must adopt a more practical attitude toward demoralizing acts of their members if they wish to retain prestige and management, on the other hand, must give supervisors the kind of vigorous support they deserve.

Wages Not the Only Inducement

High wages and steady jobs do not offer the inducement either to enter or remain in railroad service as they once did. The high rates for railroad retirement, which came into effect with the Crosser bill, coupled with high income taxes, are causing employees to seek jobs in other industries where there is more left in their pay checks after all deductions have been made. Also some leave the railroads because they think there is no future in it on account of the competition from other forms of transportation. It is not surprising that college trained men are not being attracted to the railroads as they were in the period when the roads were being built. The present economic outlook does not indicate that the problem of attracting new men, and also retaining the present employees is going to become any simpler in the next few years. Any methods for improving the relations between supervisors and their men will become increasingly important. Any assistance given the foreman in holding their men and reducing turnover is going to be of great economic importance to management.

The supervisor's problems do not all lie in maintaining discipline and keeping a crew of experienced help. Most foremen are taxed to their capacity because of having more work than they can handle adequately under the high-pressure conditions of modern railroading. The supervisory force has remained the same in size or has decreased as compared with the days when railroading was carried on at a slower pace. Consider for example the present day roundhouse foreman who has suddenly had Diesel engine maintenance thrust upon

him. He has an entire new set of problems with no adequate preparation to meet them and too often insufficient facilities. Yet he is expected to produce results as he did before. Other fields of railroading present similar examples. To complicate matters, the foreman may have the problem of reorganizing his work because of the seniority rule that can lead to a complete displacement through the ranks when an employee terminates service through retirement or other reason. Theoretically the individuals can be required to prove they are qualified but, in the face of the usual position taken by the unions that anybody can qualify for any job, it is difficult to make qualification requirements stick. Some day the unions will wake up to what this practice is doing.

Under existing circumstances it is understandable that men hesitate to assume the responsibilities of a foremanship. The inducements are not very great and there are few major railroad shops that do not have a number of examples of supervisors who have quit in disgust and gone back to the bench. How many foremen have not been tempted to go back to their old jobs? Foremen should be paid adequately and the differential over the average workman should be sufficient to make a foremanship attractive. Sufficient authority must also be given him so that he can get his work done with a minimum of interference from other supervisors. There is considerable temptation on the part of the higher officials to "ride" the foremen in an effort to get more work done. One of the most helpful things to the average foreman would be to have as his superior a man sufficiently familiar with the work to know when the foreman was doing all that was humanly possible, give him a few words of encouragement and then leave him alone as long as he continued his efforts on the same plane. "Riding" a foreman who is doing his best only creates resentment.

Supervisors Not Equipped For Job

It should be clear to railroad officers that the majority of supervisors are not well equipped to meet present day labor problems. They have for the most part come up through the ranks and have learned what they know about handling men the hard way. Furthermore they frequently do not have anyone to consult for help. Their superior may be seen too infrequently or may be too busy to be of much assistance. The supervisors have unquestionably done their best but it appears that many far reaching precedents have been established through the actions of supervisors who were not in a position to evaluate fully some of the things they did to settle what may have appeared to be minor matters.

The experience during the war with the job instruction training program showed startlingly that most supervisors could be helped by instructions from one skilled in the art of teaching. This training showed that even the older and more experienced foremen could be made more effective supervisors by being taught how to instruct their help to do any specific job. In view of these results is it not reasonable to believe that the supervisors could, by suitable training, become more effective in handling the human problems involved in dealing with labor? It is proposed that a program of instruction in practical psychology could be given to all supervisors from the rank of division superintendents, or equivalent, down, with great benefits to the railroads. Such instruction should be given by a practical, industrial psychologist, a man experienced in handling labor problems but not necessarily a railroad man. Instruction would be given to groups of supervisors of the same rank, though conceivably from many different departments. Such instruction would naturally be adapted to the particular group concerned as obviously the needs of leadmen or similar foremen would differ from master mechanics. Such classes would probably be somewhat informal with each "student" encouraged to talk freely about his particular problem. Such instruction should teach foremen how best to deal with the various types of individuals. He would learn what kind of approach is most likely to develop an antagonistic attitude and which will be more likely to encourage a cooperative reaction. With even a little knowledge of psychology a foreman would be better equipped to deal with his men.

Such a department as here suggested would also be charged with responsibility for investigating and approving all promotions to or of supervisors, as well as any discharges or demotions. Some sort of independent checking is essential to prevent either promotion or demotion because of political, fraternal or religious reasons, seniority or other prejudiced reasons instead of merit. Men will not work as efficiently for a supervisor who gets his job through favoritism as they will for a man who has won promotion because of his knowledge, skill or other special ability. Furthermore, there is no more certain way completely to ruin the morale of an organization than to make favoritism the basis of promotion. This practice will kill the initiative of the most ambitious individual. Seniority is another undesirable basis for promotion and as a result of it railroads suffer from too much of what has been facetiously called "Chief-clerk-itis." If the railroads expect to compete with other carriers the sooner they make ability the major basis for promotion the better. Judicious consideration of seniority as one factor in promotion may be desirable but it must not be the major factor.

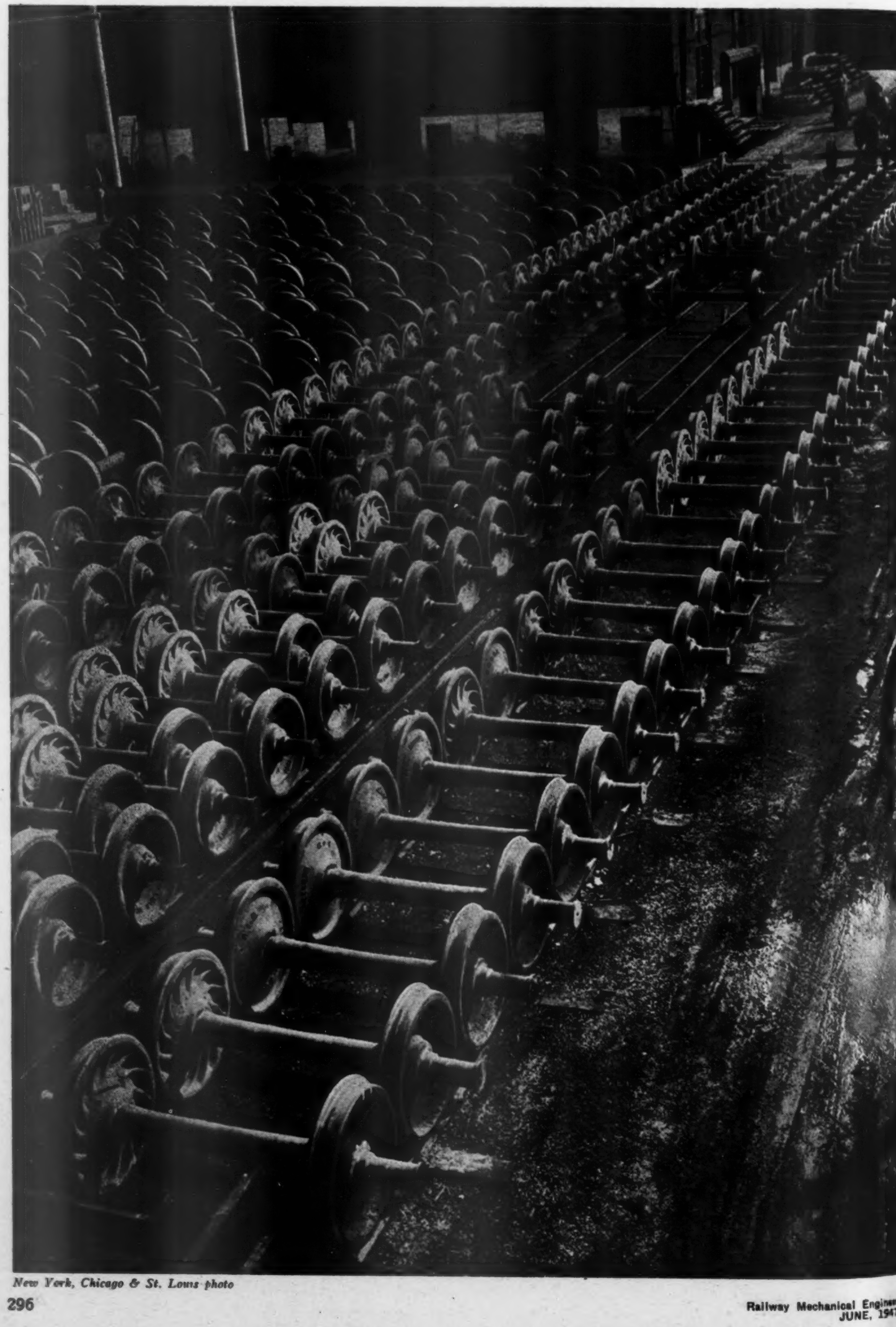
If management desired, such a department as has been discussed might also serve to negotiate general labor agreements or at least assist extensively in such negotiations. The head of such a department would be peculiarly well qualified to handle this work and thus take a tremendous burden from the shoulders of executives, who, like the supervisors, are overworked and participate in labor negotiations at the expense of other duties. Labor relations have now become so complex that a separate department to handle them could well be justified on the larger railroad systems.

In addition to the above described activities in labor problems, a department of psychology and labor would always be on call to assist supervisors in any labor problems they were required to handle. It does not appear necessary to dwell on the advantages of having a representative of the railroad, skilled in the handling of labor problems, assist the foremen in discussion with union representatives. Management would thereby be giving the supervisors the support they deserve.

In summarizing what can be done to strengthen the hands of men in supervisory positions these important steps should be given careful consideration:

1. Give foremen adequate pay and then double or treble its effectiveness by a word or two of commendation for a job well done.
2. Give foremen assurance that promotion will be on the basis of ability and not seniority solely.
3. Give foremen only a reasonable amount of responsibility.
4. Make available to foremen trained assistance dealing with labor problems and unions.

If the railroads would do these four things they would take some of the most important steps in raising the morale and efficiency of not only the foremen but of the entire railroad organization.



New York, Chicago & St. Louis photo

The Car Department Question . . .

Q. The car department has come through the war facing some new problems and some old problems which now appear in much aggravated form. What do you think is the most important of these problems and what ought to be done about it? They may arise from the higher standards of comfort and convenience and the faster schedules to which today's passenger-train operation must adhere. There are also plenty of them associated with building up and maintaining an adequate supply of freight cars capable of moving the traffic safely and satisfactorily.

First prize:
C. K. Steins, mechanical engineer, Pennsylvania, Philadelphia 4, Pa.

Second prize:
C. N. Kittle, superintendent of shops, New York Central, Buffalo, N. Y.

Honorable mention:
P. P. Barthelemy, retired master car builder, Great Northern.

F. C. W.

Martin Andresen, repair checker, Kirk Yard shops, Elgin, Joliet & Eastern, Gary, Ind.

Suggestions

For Better Car Maintenance

First Prize

By C. K. Steins*

Specialists needed to find and repair troubles in accessories—The need for a freight-car back shop given and a proposed organization for repairs outlined

THE most important problem of the passenger car mechanical department is the training of maintenance men. This is especially important today because of the new and renovized cars going into service at a rapid rate on many of the roads. These cars represent an investment of around $100,000 per car and they must roll up many passenger miles per year to pay for themselves. The availability that is so much talked about on the locomotive side is becoming more than ever important on the car side because of the money invested.

Modern passenger car equipment cannot be maintained successfully unless the repair forces are properly trained. The run-of-mine repair yard organization will have many a headache unless those in charge of the yards recognize the problems presented by the new equipment. A parallel is found on the locomotive side where, in the early days, an attempt was made to maintain Diesel locomotives in steam enginehouses with the regular steam repair forces. That did not work. Now we have a mushroom growth of Diesel repair shops springing up all over the country with specialists trained in Diesel maintenance, some in Diesel schools and others "made" by trained men.

Complexities of Passenger-Car Maintenance

New passenger cars, and many renovized cars, are designed largely for passenger appeal. That includes good riding qualities, low noise level, plenty of light, and many other things, such as, train announcing systems, radios, overhead air-conditioning, wheel-slide control, speed governor control, door engines, circulating ice water systems, to mention a few and by no means all. These appurtenances have to be kept in working order. The designer generally does what he can to make them rugged and trouble-free. He tries to put them where the maintenance men can get at them readily, but they are maintenance problems regardless of their accessibility. If they are not maintained it would be far better, so far as the public's reaction is concerned, to leave them off. A patron is very critical of a thing he is told by advertising he will get, but finds he does not get because of lack of maintenance.

It is quite useless and decidedly extravagant, as well as bad psychology, to put any money in a mechanical refrigeration unit for drinking water and then despatch the car with the unit not working because the repairman did not know his job. It is even worse to cut off a sleeping car in the middle of the night because of flat wheels due to a lack of maintenance of the wheel-slide control It is unwise to spend good money for speed governor control and then not have the use of it because of lack of maintenance.

While it is not mechanical maintenance, it is still the car department's responsibility, and a very important one, to keep passenger cars clean. Clean cars are one of the "musts" for attacting and holding patrons. Cleanliness, courtesy, and on-time performance build good-will and sell tickets faster than all the gadgets that can be put into a car. Contrary to an idea all too generally held, good car cleaning takes special training. Luxurious accommodations, usually in light colors, cannot be kept up with the kind of car cleaning that sufficed for the old cars. A hit-and-miss cleaning job is like a dirty plate in a diner; both drive business away.

Car repair forces in the larger passenger car yards are generally specialized as to truck and coupler work, steam heat, electrical work, air brakes and plumbing work, while other gangs take care of general interior work, such as, locks, window curtains, sash, seat mechanisms, etc. Specialization of this sort will have to be carried down to many of the smaller yards if the new cars are to be properly maintained. The "jack of all trades and master of none" is on his way out because today we need specialists. A mechanic must have more than the bare qualifications that get him the mechanic's rate according to the book. He must be thoroughly trained to find trouble, and repair it quickly and in a workmanlike manner. He will not pick up this training unless he is an exceptional man, and this kind of man is a rare find today.

In the larger passenger car yards it will be necessary to specialize further than has been done in the past. It will be necessary to have air-conditioning and refrigeration specialists apart from the ordinary electrical maintainers. Men who are able to make repairs to radios, microphones, and loud speakers, short of factory repairs, will be required. Maintainers must understand how a shock absorber works and must understand that it is of no value if it is out of adjustment, loose on its bracket, or the link pins and bushings worn.

How to Use the Manufacturers

The manufacturers of special devices are interested in keeping their devices in repair. Most of them put out helpful literature to assist the maintainers. Many send out field men to go where the cars are maintained and train the men. But there is a tendency to pass the buck to these manufacturer's representatives. They cannot go it alone and, of course, are not in the yard all the time.

Those responsible for the maintenance forces in passenger car yards should recognize immediately the importance of organizing their forces to work effectively and see to it that the individual gets the instructions he needs. An assistant foreman or a gang foreman, or an outstanding workman, should be designated to make a study of each new piece of apparatus and obtain all the literature on it that is available in order that he can qualify as an instructor. Instructive talks should be given to the men at lunch hour or at any other time that can be found. Not infrequently men will contribute their own time after working hours when they are satisfied that the instruction benefits them as well as the company.

* Mechanical engineer, Pennsylvania, Philadelphia, Pa.

The freight-car problem has undergone no particular change in recent years in so far as rip-track repairs are concerned. The wooden car is passing out of the picture and some all-welded cars are coming in. There are cars with such new appliances as empty-and-load brakes, metal running boards, power hand brakes, various hopper-door closure devices, etc., and probably cars will be showing up before long with roller bearings. But in the main the job is essentially the same as before.

The freight car, as all railroad men know, suffers because it belongs to no one for maintenance in the sense that a locomotive or passenger car does. The car is shopped at the transportation yard because it has some defect that makes it unsuitable to go over the road. The rip track repairs that particular defect and rarely undertakes a repair for which there is not a crying need. This continual deferring of work increases the rate of deterioration and, in the case of house cars, is the main reason for the large percentage of cars suitable for rough-freight only.

General Repairs Vs. Rebuilds

There should be back shops for freight cars as there are for passenger cars and locomotives. Here a car would get a general overhauling, including scale removal and repainting. At this overhaul all deteriorated steel parts should be renewed, loose rivets cut out and replaced, splices set up so that they are watertight, and the car sent out practically as good as new. A repair of this kind is cheaper than a rebuild job, will keep a higher percentage of cars out earning money, and will make reductions in rip-track forces possible.

The freight-car back shop, or shops, should be organized and stocked to repair one class of car at a time. They should be devoted to one class until all of the cars requiring repairs in that class are run through. Inspectors should be sent out to inspect all cars of that class and route them to the shop if their condition warrants. When this class of car is in good condition the shop should be swung over and stocked up to process another class of car. The work of the shop can be rotated through the entire car ownership in this manner.

It will always be necessary to make heavy accident repairs to some cars for which the back shop is not set up at the time. These can be repaired in a portion of the back shop set up to handle miscellaneous work and a separate force of repairmen assigned to this work.

Improving the Car Situation

Second Prize

By C. N. Kittle*

Repairs should be scheduled and planned only when material is on hand — Some uses for defective cars listed — Ways to increase efficiency of repairs described

THE tradition that most railroad personnel have, is believing that the problems and effectiveness of their own department are the most important factors affecting the proficient operation of their railroad. This is probably the principal reason that the American railroads are the finest equipped and the best operated in the world.

The record established by all the railroads during the war period is now history and it is one of which no one need be ashamed. But in the car department we have a peacetime job that also calls for clear vision, constructive thinking and some unusual ingenuity. These attributes will be necessary to provide a higher standard of comfort for our passengers; to build and maintain rolling stock for transporting the freight when it is offered; and to deliver it on time in an undamaged condition. This we must do better than our competitors and at the least possible cost.

Coach Servicing Facilities

Our car-department problems are well diversified because the procurement of new cars is still difficult and, since new passenger cars are still limited, we must handle their maintenance, cleaning and other terminal service with dispatch in order to increase their availability.

With power-operated exterior washing machines a train of as many as 15 passenger cars can be cleaned in 15 to 30 minutes. Portable battery-charging facilities should be used where coach yards or station tracks are not wired. We should minimize such maintenance as wheel changes, draft-gears and coupler replacements, periodic cleaning of the air brakes and air-conditioning systems, battery charging, etc., at all terminals except those having proper facilities. Cars requiring this work can be routed to terminals where proper facilities and trained personnel are available.

It is unfair to our patrons and certainly poor business to fail to give them a clean, comfortable car that will reach its published destination without mechanical failure.

The Freight-Car Situation

Immediately subsequent to Pearl Harbor our government informed us that few, if any, new cars would be available during the war period. This resulted in selecting from that group of freight cars which had been set aside for demolition those which could possibly become candidates for repairs. These were returned to service with sufficient repairs for only one, or possibly, two years. We had material for new box cars and this we revamped and used to build gondolas. All-steel hopper cars came from the shops with wood floors. The substitution of materials was necessary and quite prevalent. Despite this we transported in 1941 more tons of freight, more miles with fewer cars and locomotives than had moved in any peak year immediately subsequent to World War I. That performance was exceeded in the

* Superintendent of shops, New York Central, Buffalo, N. Y.

ensuing war years and last year our American railroads carried the greatest volume in any peacetime year.

Now we must pay the piper for our war-maintained freight equipment which should have been replaced during the past several years. Equipment is moving to the demolition yards with retirements equalling and, in some cases, exceeding replacements. Shippers universally are failing to get sufficient box cars for the loading of freight that must move to keep their plants in operation. We of the car department must use our ingenuity for properly planning and scheduling work to increase materially the availability of all classes of freight equipment by reducing the number of days required to rebuild or to make general repairs to bad-order equipment. We must program the work through the shops only after all material is available or promised for delivery to meet the schedule.

Availability Suggestions

We must use cars which may not be in a condition for revenue loading to handle company materials when such cars are not scheduled for immediate repairs at the shop. A box car due for rebuilding may have a leaky roof or some defects which do not prevent using it for handling storehouse supplies or maintenance-of-way materials that would not be damaged by water or exposure to the elements. The self-clearing hopper car or all-steel gondola may require new floors or some new side sheets, but floors and sheets can be patched at a nominal expense and the car used for cinders or rubbish loading or for some other company supplies where a first-class open-top car would not be necessary. These cars can be retained in such restricted service until they are wanted for scheduling through the shop. In this manner the use of the car is lost only while it is being repaired which, in each case, releases a good car for revenue loading.

The selection of empty cars for loading is one of our most important jobs. A serviceable and clean car not only makes the shipper satisfied, but increases the probability that the car will reach its destination under load on schedule. It also results in furnishing the class of car that the shipper desires to meet his loading requirements and minimizes the time required for the car to arrive at its destination by reducing the possibility of it becoming defective en route. This increases car availability.

The Rip Track

Only freight repair tracks adjacent to classification or terminal yards should be considered as being properly located and they must be modernized. They should have heated and ventilated buildings for workmen's service rooms, office forces, and for such work as must be protected from the elements. Runways should be of concrete. Power delivery trucks, power jacks, portable electric welders, etc., must be provided to expedite the completion of necessary repairs to loaded cars and the servicing of empty cars released for loading. Freight repair tracks must have proper facilities and tools as well as trained personnel to insure the maintaining of all freight equipment in a good serviceable condition between heavy repair cycles.

Well trained and competent inspectors in classification yards are an asset in the marking and classifying of bad-order cars to divide cars requiring minor repairs from those in need of general repairs. The former are placed on repair tracks for further classification according to the work required. Bad-order cars requiring general repairs are assembled and held for routing to the shops. Such bad-order cars being held for the shops should be reported to, and ordered forward, only through the office of the chief officer of the department for the railroad or its sub-division. Improper classification or incorrect placement of bad-order cars on one repair track resulted in a number of them being delayed and some being held over 24 hours longer than would have occurred if the cars had been properly classified. Such practice, if continued, would have resulted in a loss of approximately 3,000 car days for the year at this one point.

General Repairs

Freight cars requiring general repairs or rebuilding should be sent to a shop where the work must be scheduled, classified according to types, and separated by lots when the ownership is large enough to support it. With the procurement of materials difficult, the repair schedule must be determined prior to the beginning of the work to eliminate interruptions that would otherwise occur as a result of any delays in materials delivery.

A shop of sufficient size to enable competitive production lines creates a desire in the workmen to excel. Incentive compensation promotes production, and a good apprentice school, well tutored, helps fill the ranks of the retiring mechanics. These features are very necessary for production. The results of labor can be very expensive when the use of modern, efficient tools and equipment is disregarded, or when insufficient knowledge or attention is given to the proper scheduling of the work.

A principal requisite to maximum production at minimum cost is the procurement of materials, properly fabricated and assembled into the largest possible units that can be united with the car. This enables the use of compression rivets, electric welding and jigs or forms, all of which are conducive to high-class workmanship.

What Modern Tools Mean

We can ill afford to be hoodwinked into using obsolete tools or equipment because they are not worn out. "Hold onto the old as long as it is good, but get the new just as soon as it is better." Here are some relevant facts pertaining to eight hours work, or one man day:

A 15-yr. old lathe turned the journals on 14 pairs of mounted car wheels. A new modern lathe did the work on 23 pairs, an increase of 64 per cent.

A 1-yr. old pipe-bending machine formed the pipe for AB brakes on 24 cars, but a new modern machine did the same work for 63 cars, an increase of 162 per cent.

A 20-yr. old power brake, used for forming steel plates into shape, was replaced with a new machine which produces more parts more accurately shaped and reduces the unit cost from 40 to 60 per cent. It also forms parts cold, whereas heat was necessary with the old machine.

More of these facts could be illustrated, but those cited are sufficient to prove conclusively that we can ill afford to use the old when the new is far better. It is too expensive to our department's effectiveness, as well as shameful, to waste our manpower by disregarding the obsolescence of machinery and tools.

Manpower is valuable and we must acknowledge the importance of the men's indiviuality as well as their part in our department's effectiveness. Most men have limitations and also a desire to perform the class of work they like best to do. It is this desire which enables placing them into groups to advance the work progressively in equal positions, thus minimizing the number of tools required. It will also permit complete utilization of the tools necessary. Yes, the tools will wear out in less time, but 24 portable tools costing $100 each, which last only four years, amount to $600 annually. Non-classified work may require as many as 72 tools at $100 each for the same amount of production. Even though the tools may last 10 years, the annual cost will amount to $720.

Another advantage gained by a four-year purchase cycle is that the tools will be more modern.

Maintenance, including repairs to car parts, at shops and repair tracks will, when centralized, be done more proficiently when the work is in volume, and it will enable the use of modern facilities, tools and correctly trained craftsmen.

The cleaning, repairing and testing of brake valves must be performed by high-class craftsmen using special tools for efficient operation. A recently developed and modern tool, when used, minimized the physical labor required and reduced the cost of production sufficiently to amortize its cost in eight months and it has an estimated service life of several years. The result is high class workmanship, increased production and better satisfied workmen.

Air and signal hose, retaining valves, angle and cutout cocks can be reconditioned in accordance with AAR requirements at a minimum cost only by trained craftsmen supplied with modern tools.

Journal packing renovation can comply with AAR rule 66 and the recommended practice only when handled with modern equipment; to do this efficiently a large volume is desirable and profitable. Concentrating wheel and axle work to reduce manual labor is an innovation of the past, but centralization now to utilize fully special and modernized machinery is a necessity. This procedure will minimize the investment in stock necessary to provide ample requirements.

The car departments are surely justified in their request for any investment necessary to provide modernized tools and equipment, the use of which will produce maximum production per man hour of labor and which, coordinated with proper planning and scheduling of the work, reduced materially the number of cars held in bad order, thereby increasing car availability.

Additional Comments on Car Department Problems

Ideas range from a broad treatment of future design considerations through a series of recommendations for the revision of repair facilities to specific suggestions from the workman's point of view

The entries received in answer to the prize competition question relating to the important problem confronting the car department came from men with experience in many different phases of car construction and maintenance. Because of the wide variety of experience each author tackled the car problem from a different slant, using his personal experience as the basis for solving the problem. Such a basis, of course, makes the papers all the more valuable because ideas from experienced men usually offer a practical solution to the every-day problems confronting the department that must keep in shape the vehicles that carry the revenue-producing passengers and commodities. Of those contributing ideas only the top three entries following the prize winners are published in this issue. Other papers will appear in subsequent issues.

Freight-Car Designs Need Revision

Great need is for more new freight cars in construction of which advantage is taken of modern materials

By P. P. Barthelemy
Retired Master Car Builder, Great Northern*

That something must be done about the car situation is obvious. A far-reaching, well-planned program must be worked out and vigorously pursued if the railroads are to maintain their position in the field of transportation. The writer's viewpoint on this subject is that of a carman who has had long experience in designing and constructing cars and in their mechanical maintenance.

Considerable modernization of passenger cars has already been done, a little belatedly, yes, but we are on our way. The freight-car situation is less encouraging, since full advantage has not been taken of modern material developments, in addition to which the engineering in far too many of them leaves much to be desired.

Retrospectively, it is a simple matter to trace the circumstances that led up to our car condition as it was during the war and as it still is today. Looking back, despite what happened to Lot's wife, has its good points, for the lessons derived therefrom may be of help in averting a repetition of the mistakes of the past.

Our war and postwar car troubles are traceable to the economic conditions obtaining during the several years

* Mr. Barthelemy is now engaged in consulting engineering work.

prior to the beginning of World War II when the building of cars was at low ebb. Then came the war with the resultant unheard of demand for equipment, when every available car was pressed into urgent and intensive service, including the old worn-out ones.

We did a lot of looking back after World War I, but our memories were overly short; we were again caught with an acute deficiency of freight cars and, therefore, were also again forced to comb the storage yards and press into service a vast number of these worn-out cars. Except for the difference in vintage between the two eras, the situations were parallel. These old cars were in poor mechanical condition and shortages in materials and labor precluded putting them into even fair service shape. "A lick and a promise" was all that we could give them, hoping, with our fingers crossed, that they would carry on. Because of the nature of the business, there was little opportunity to segregate the poor from the good. But despite these and the innumerable other handicaps that had to be faced, the railroads did a magnificent job.

Passenger Cars

The program for building modern passenger cars, interrupted by the war, is again under way, though the progress of the work has been slow. These new cars are modern in all respects and the materialization of plans is going to give the railroads the best passenger transportation equipment in the world.

The building of these new streamliners is releasing a large number of the conventional cars for secondary service, which results in a general demotion down the line, to local runs, releasing a lot of the oldest cars for long-overdue retirement. We must not, however, ignore this demoted equipment, for a great deal can and should be done to make the old cars retained in local service more comfortable and more attractive. Those displaced by the new ones have been modernized in most respects. However, on several points they now suffer in comparison with the streamliners. They are rough riding, noisy, and too sombre in appearance. The rough riding, as well as the noises between the cars and those transmitted from the trucks, can be eliminated or greatly reduced.

Improved draft and buffing arrangements and the installation of tight-lock couplers will eliminate much of the noise and car lurching now all too prominent. A wider use of devices that contribute to the nice riding of the new cars is feasible on these older cars, as are also the anti-noise features. Streamline effects can generally be produced at small expense. Cheerful colors on both exterior and interior and more attractive decorations are needed. This applies to all passenger cars; it is a reflection on the road to have "jerkwater" cars, even on locals. Among interior decorations that should be used are interesting scenic pictures; "pile-up" murals and airplane pictures of important cities are very popular. Those big, bare panels need such coverings. Naming assigned cars after cities on the run is good advertising. Speeding up these trains and cutting down on the train stop also helps. Make the trip on these lesser trains a pleasure rather than just a means of getting from here to there.

Building light cars for small local runs can be carried much further than is now the case. The fast acceleration of the small Diesel and the light equipment help to speed up the overall run.

Freight Cars

The reasons for the shortage in freight cars have been briefly mentioned. Industrial unrest has so retarded building that cars authorized a long time ago, which should have been hauling freight for many months, are not yet built.

As far as the immediate present is concerned, it appears that all that is possible is being done to alleviate the situation. In a short time some measure of relief will be had as more of the new cars are turned out. True, forced retirements are probably exceeding new replacements, in number at least, but there is consolation in the fact that each new car will do the work now requiring two or three of the oldsters.

As to the future, the general remedy is obvious; a very extensive building program that will provide really modern equipment. Long-range planning is called for, with the development of designs and constructions of the highest order. That there is room for improvement in those respects is only too clear; what has been done in the development of the passenger car is plainly indicative of what we can do with the freight by wider employment of the newer materials and with more attention to detail and general design. A. A. R. specifications and designs are badly in need of a thorough modernization. There must be a better coordination of the advanced ideas and constructions developed by both car owners and car builders. This is not a reflection on the Car Construction Committee. Their regular duties keep them so occupied that they have insufficient time for a problem of that magnitude.

While some owners have done a nice job in the acquisition of up-to-date freight cars, it is unfortunate in other cases that so many of the cars were already ten years behind the times in materials and design even before they were turned out, in contrast to the progress made in other industries, some of which are in direct competition with the railroads. There is need of a general awakening among freight-car designers, both car owners and in the car-building industry.

The freight car is built to last 25 years; therefore it is necessary not only to make the most of present-day materials and up-to-date designs, but to look into the future as far as is humanly possible to see what it may have in store for us; use imagination. There is evidence of overdoing the practice of making "repeat" orders of previous designs because those cars were good. Too much ultra-conservatism; we "keep both feet on the ground," yet the man who does that is standing still; the implication is not without point here.

Strange as it may seem, the lightweight freight car has not yet come fully into its own. "That lightweight cars are a success has been proved beyond all doubt. The ultimate value to be derived from weight saving is debatable, but the fact remains that it costs money to haul a ton a mile, be that ton in lading or in the tare weight of the car. Lightweight steels are more durable than the old, and certainly a welded construction is far superior to riveting. Riveting has practically disappeared in other industries."

Weight Reduction

It is not within the scope of this article to point out in detail where weight savings can be made, but the items are numerous and easily found by those who care to seek them out. Commendable pioneering work has been done, by both car owners and car builders, but we seem to have failed to profit fully from it.

Specialties are often far heavier than need be. Plywood linings are a major weight saver, both for new cars and for rebuilds or heavy repair work, since because of the great strength of plywood, material of only one-half the thickness of matched boards will be more than ample. Most of the conventional nailers may also be omitted by the use of adaptable securement methods. In

many of the plywood lining applications to box cars the highly objectionable grain trench has been retained. Why? There are some very successful exterior sheathing applications, but in most of those the panel thickness can be reduced appreciably. For composite gondolas plywood panels one-half the thickness of the ordinary planking would be stronger and more durable than the latter. There is a rich field for real research here. Both car owners and the plywood industry seem to remain happily unconscious of the possibilities of that material in freight-car work; the potential volume is enormous. Plywood cars have a high publicity value with shippers.

Aluminum has great possibilities as a major freight-car material, and a number of experimental units have been built. Here again the designs indicate insufficient study, particularly study of the various intricate forms that can be produced by the extrusion process. Improvements can also well be made in securement methods.

Rehabilitate or Retire?

Rebuilding and rehabilitation plans need to be carefully worked out, bearing in mind that in many respects the cars have become prematurely aged because of intensive usage and neglected upkeep; car mileage as well as time is an aging agent.

Points to consider: Is the car worth rebuilding; does it require AB brakes; will rebuilding it tend too much toward the perpetuation of those old, heavy, and obsolete constructions? Some of those that have already passed through a couple of rebuildings have about reached the "grand-daddy" status, structurally speaking.

Many of the major items reused have reached the level-off plane in their maintenance curve; therefore replacements and repairs start almost immediately. To be weighed against that is the fact that a new car will require practically no maintenance expense for five years or longer, then the rise in the curve is slow. The new car is modern, more economical to handle, is in better ice condition, has a good publicity value and a higher availability factor.

Some roads are faced with a commodity box-car supply problem, where those cars have to be maintained to grain condition or better. To meet that condition the bodies of those cars require heavy repairs about every ten to twelve years; they cannot be permitted to take the natural course down the commodity scale, from new to scrap. This is also true of other types—coal cars, for example.

When rebuilding is done, or heavy repairs made, do not just follow the old constructions, but make the most of the newer developments in materials and designs; do not overlook the big advantage that lies in a much wider use of welding. Plywood linings can be used to very good advantage in the box car, and also as sides for composite gondolas and in other places.

Our analysis would be incomplete without making mention of repair facilities. On the average, freight-car repair conditions are bad and facilities and equipment are inadequate. Far, far too much of the repair work is being done out-of-doors, and there is a shortage of tools and devices to enable the repair forces to do their work faster and easier.

It is highly uneconomical to do repair track work out-of-doors under inclement weather conditions; a great many car-days are lost, and loads are too often delayed. A quicker turnover of bad order cars is needed.

Some of the passenger car repair shops and servicing yards are in need of modernization to properly handle the streamlined equipment in particular.

Your campaign is along the right lines, and much good will result from bringing all these matters into a general discussion.

Increasing the Availability of Equipment

The author points out advantages of greater standardization over individual freight-car designs and lists some ways to expedite repairs to existing equipment

By Martin Andresen

Repair checker, Kirk Yard Shops, Elgin, Joliet & Eastern, Gary, Ind.

The problem of increasing the availability of freight cars in the present shortage, insofar as maintenance of physical equipment is concerned, is less of a problem of inventing new and spectacular methods and radical techniques than of effectively calling attention to facts which should of themselves be readily self-evident.

The two outstanding needs are: First, a greater standardization of equipment; and, second, a more effective use of available methods in accomplishing the work of maintaining existing equipment.

Today the average repair plant is confronted daily with a considerable variety of equipment,—box cars, hoppers, gondola, refrigerator, tank and a number of other types. This is bad enough in itself, but added to that the fact that outside of wheels, couplers, brake beams and a few other standard articles, there is very little than can be used on one car of a given type which will also be proper for repairs to another car of the same type. There is necessarily created a considerable degree of confusion.

Lack of Standardization

Couplers are standard, but of head blocks or buffer castings there is a large variety; we may apply wheels, which, although not standard as to material, are physically interchangeable with any wheels which we may remove. But when a truck side or center plate goes bad it is apt to be the one of a dozen or so varieties that simply won't work with what the repairing line has in stock. It may be added that newer equipment is as bad in this respect as the older equipment, and as far as interchangeability in this detail is concerned, we appear to be retrogressing rather than progressing.

When we come to house cars and refrigerator cars, we face the biggest headache of all. Should a door be

missing from a box car, it is usually necessary to send the car home before it can be made fit for further loading. Dimensions of doors vary to such an extent that to carry even a fairly comprehensive assortment would be impracticable. Roof and body details vary, brake details are often of a design which is strictly confined to the owner, and so on until the very analysis of the problem would fill a good-sized book.

Some years ago the Association of American Railroads undertook to further the design of box and refrigerator cars of standard fabrication and dimensions. These cars seemed then and still seem entirely satisfactory insofar as both service and maintenance are concerned, but today we hear less of the development of further standardizing than we have for a number of years. In fact, the cars built today seem to a large extent to have lost sight of this objective,—and this in a time of vital need, when one standard design would do much to expedite production.

Too Much Individuality

From the economic viewpoint there is no competitive advantage in the great variation of equipment which exists. The freight trailers used on the highways are far more standardized than our railway equipment, and they enjoy a highly profitable business.

The appearance of our cars concerns the customer far less than the promptness with which they forward his merchandise. By its very nature a freight car is not to be a medium for the expression of the artistic temperament and the individual idiosyncrasies of its designer. From a practical viewpoint a car which by its construction lends itself to fast easy repairs when bad ordered is a more valuable asset than a car which by its appearance definitely associates itself with a particular carrier and decreases its availability as a result. This business of the transportation of merchandise is first, last, and always intensely practical, and any oversight of this point is certain to be paid for eventually in actual dollars and cents.

But standardized equipment is in a great measure a long-range program and the pressing need is for today.

Facilitating Car Maintenance

In the average repair plant itself there is a great opportunity for improvement. It seems shocking that in an age which recognizes time in the terms of a valuable commodity, when considerable time and money are spent by nearly every productive industry in the field of research toward improvement of method, that a great proportion of our own work should be accomplished "by main strength and awkwardness" and by methods which other industries discarded years ago. True, there are few mechanical aids which will expedite changing of wheels, brake beam, couplers, etc., which are not now in general use. There is also no practicable short cut in repairs to air brakes. However, in many other respects we have failed to take advantage of time-saving devices and methods to any great degree. Outside of the foregoing mentioned work, the greater part of the work falls into three main categories, namely: parts broken or worn out, parts bent, and parts missing. Considering the first it is desirable that a satisfactory replacement should be readily available for any broken or worn-out metal part which must be replaced if this is the only course that is open. Should it be practicable to effect repairs, however, the physical plant should be equipped to handle the necessary work with a minimum of lost time.

Portable electric welders in these situations are probably the most efficient and satisfactory solution to the problems presented. The range of work which they handle is probably greater than any comparable method, and it is safe to say that the ultimate in technique in this field has not yet been attained. New alloys are continually being developed which give them an ever-widening field of utility and an ever greater factor of economy.

Where the damage to wood parts necessitates extensive replacement, the fabrication of the parts themselves presents a problem of lesser magnitude. However, in their application considerable time is often lost in the use of ordinary wrenches which could be saved if power wrenches were used where considerable bolted work is undertaken. Good bolt cutters are often overlooked.

The straightening of bent metal parts always presents an interesting problem and one that frequently taxes the ingenuity of the party effecting repairs. Needless to say, when it is necessary to remove the part from the car for the operation, considerable time is expended in the removal and re-application of the part itself. Repairing a part of any size in place, such as metal sills, transoms, ends, or corner posts, when the damage is extensive, calls for a high degree of skill and highly efficient equipment. Some shops have designed equipment which serves their needs well. There is also considerable equipemnt on the market. In the end, the requirements of the individual plant will determine the nature of the equipment best suited.

There are available various types of clamps and yokes, leverage devices, oil torches, and of more recent development, a gas-and-oxygen torch having a number of jets and effectively heating a good-sized area while confining the effects of the heat to the area being worked. These devices, when properly used, give excellent results in the matter of time saved.

Concerning missing parts we may conclude that the problem of availability is one over which we now have little control, under existing conditions. A part of the answer for the time being seems to be the reclamation of every available defective part which will lend itself to such a process. How long present shortages will continue is difficult to predict, and in considering parts to be reclaimed, it is evident that more time and expense are presently justified than would be the case in normal times. The principle of "waste not—want not" holds good today as never before.

Future Design Considerations

We may, therefore, conclude that if in the design of cars to be built, a full consideration is given to the interchangeability of parts, and to facilitating the customary operations of maintenance which past experience has taught us to anticipate, we shall have taken a logical step toward the solution of future problems; and if we also give our serious considerations to an intelligent study of method, a very real development will have been made in the solution of the problems of today.

The day when haphazard and indifferent methods sufficed is over. In the complex economic structure of the present it is necessary to develop efficiency to the highest degree if survival is to be the order of the day, and to achieve true efficiency requires a coordination of the best technical methods, intelligent planning and realistic common sense, coupled with a complete faith in the medium with which we work. With this combination we shall be enabled not only to find success in conquering our present difficulties, but be prepared for the economic vicissitudes of future times as well.

Practical Suggestions on Freight Car Design

By F. C. W.

Last fall during one of the most critical periods of the car shortage I talked with a car service agent of one of our larger railroads and he said, "If I could only get one day's delivery of cars ahead, I could fill all orders for some time." It occurs to me that if we could move all cars forward one division on all roads, we would make everyone happy. If every car repair track, every car shop, every cleaning track will put out just one extra car, if every car clerk will bill them out, if every switch foreman will switch them into the outgoing trains, we can get a day's car supply to the good. All repair men must realize that one 40-ton car will haul as much as any other 40-ton car and that we must let the heavy repair cars accumulate if there is no other way to get the lighter repair cars out. When cars are repaired we must not bury them on a blind alley track; we must get them switched out. By doing this we may be able to get everyone in the industry "car conscious."

The car inspector is your right-hand man. Give him a chance. Remember, the car inspector's work is never finished. He just can't be sure that he has not overlooked some item that needs attention. The car inspector may be a man who eats in the kitchen but he has a thinking mind and you can get him to use that mind if you encourage him to do so. Do not sell the car inspector short. If you were about to cross the Sahara Desert in your automobile you would want to have it inspected by an expert mechanic before you started. This is the kind of service that all railway cars get before they are allowed to leave the yards. They are inspected by real car experts, men who are interested in making sure that every car is in shape to carry its load to its destination without delay caused by failure.

Do not promote the kind of supervisors whom we used to hear say, when a man made a suggestion, "You were not hired to do any thinking. You do the work. We will do the thinking." And I beg of you who manufacture railway supplies to give a man any information he may ask for when he writes you regarding your products.

Car Builders

When car builders put some special steel in different car parts, they might indicate by an information plate at some point on the car the kind of steel by its trade name, such as Bulloy, Muleoy, or Caroly. You will find the repair men will quickly learn the difference. A welder quickly knows the difference in the feel of his torch when he heats various kinds of steel. He will soon learn how large an area must be heated to strengthen a car part without it cracking upon cooling.

Some Practical Aspects of Design

The car inspector could, if given a chance to design cars, cut down the failure of many car parts. He never would design a sill step with a 90-deg. bend at the side sill. He knows, although he may not have studied the effect of stress concentration at the right angle turn, that eventually some inspector will find a failure of the metal there, and the failure may result in an injury to a switchman riding the step. This might not happen if the car always stool still, but with a rough wheel or rough track the lower end of the step sets up a constant series of vibrations that weaken the steel. I am astonished to find these steps on new 1946 and 1947 cars.

Another design feature on which the car inspector would not put his O.K. is that of the center sill gear pocket. The sill spacing is the AAR approved $12\frac{7}{8}$-in. width and the gear butt the AAR approved size. As a result the gear does not fit snug in the pocket and will slip to the weaker side with the squeeze placed on it by the yoke when the train is started. The car inspector can see examples of this on every car he inspects. He would place a renewable lining in the gear pocket at the sides to make the gear fit snug and to protect the sill from the cutting action of the gear butt and yoke filler. He would also place a guide on the draft-gear support plate, or tie strap, to keep the yoke exactly in the center of the gear pocket, and in center line of draft. Or he would apply an extra tie strap with guide attached back of the regular tie strap to overcome the tendency of the yoke to slip to one side of the gear. This applies to the swivel yoke as well as to the older design of yoke. It is particularly noticeable when a high-tensile yoke is encountered, the width of which is one inch less than other yokes. This causes the high-tensile yoke to have a greater range of travel from side to side in the pocket.

Cast-Steel Truck Sides

The inspector would be very careful about the design of cast-steel truck sides. He knows where to look for progressive cracks, and finds them where the supporting members join the journal box. He would like to see a round re-enforcing rib finishing off the U-member at this point, but finds instead on some 1946 truck sides a thin fin-like edge with what looks like saw teeth on edge when looked at with a magnifying glass which, in addition to a mirror and flashlight, a good inspector carries. These rough fibres on this fin-like structure, when on a truck with a rough wheel, sing a song, but not a song of harmony. It is a song of dissension. This fin is known as a stress-raiser. A tiny crack soon starts that will eventually lead to a failure at this point.

Remedy for Pipe Breakage

The inspector may think the AAR is too cumbersome, too slow, too hard to reach. He knows of a condition which has existed ever since the AB brake was put on cars, and which has caused no end of trouble, delayed trains, cost a lot of money, but has never been corrected. It is the breaking of the pipe at the threaded end in the flange union connecting pipes between the cylinder and the AB valve, between the AB valve and the reservoir, and other places on pipe lines. All inspectors know about this condition but may not admit it to their immediate superiors as they might be asked what to do about it. The only remedy at present is to put in a new pipe, which takes time and material that are lacking at most inspection points. The only change necessary is to make up a new-style clamping nut, just a little longer than present nut, to give space for a $\frac{1}{2}$-in. long rubber sleeve with a flat brass washer at the outer end to compress the rubber when the nut is tightened. This will form a tight connection even if the pipe breaks.

The pipe should be given a coat of rubber cement before the sleeve is applied, a standard connection in use by plumbers for years which has been very satisfactory. It is believed that the rubber packing will dampen the vibration and may prevent cracking in the threaded end.

Pere Marquette photo

Meeting the Locomotive Problem . . .

Q. What is the problem of outstanding importance with respect to the maintenance and utilization of locomotives and what do you consider the best way to meet it? The following phases are suggestive only: Maximum utilization of steam locomotives. Maintenance policies and methods for Diesel locomotives. Shop and terminal facilities for either or both types of motive power.

First prize:

C. A. Fowler, midshipman, United States Naval Academy, Annapolis, Md.

Second prize:

E. Vernon Jaramillo, locomotive research engineer, Battelle Memorial Institute, Columbus, Ohio.

Honorable mention:

Fred D. Mosher and John J. Kane, Jr., Erie, Pa.

J. W. Cameron, engineer of tests, Wheeling & Lake Erie, Brewster, Ohio.

Herman C. Whitacre, assistant enginehouse foreman, Spokane, Portland & Seattle, 400 West Thirty-fifth street, Vancouver, Wash.

Increase Utilization Now

First Prize

By C. A. Fowler*

An immediate betterment of steam locomotive performance can be attained by adopting the practices that now produce some outstanding records

The job of the mechanical department officer is to help his railroad render a superior and economical service that will attract more business. To do this he will have to use his motive power in the most efficient manner and he will have to obtain a greater degree of reliability in locomotive operation. Efficient operation and decreased expenses can be accomplished by better locomotive utilization. Further, by more intensive utilization, outlays to buy new locomotives to handle increased traffic should be unnecessary. Reliability is essential in service that is to attract more shippers and passengers. Let us discuss utilization and reliability to see how they are obtained.

Utilization is intimately bound to availability. Availability is the percentage of time that a locomotive is in operating condition. Utilization is the percentage of time that a locomotive is available, that it is working. Utilization and availability must go hand in hand for the most economical operation. Outlays to increase availability will be foolish if the locomotive sits idle awaiting assignment. On the other hand, high utilization cannot be realized if a locomotive remains in the shops for long periods of time or requires a large amount of attention when turned at terminals. With poor availability, the motive power roster will have to be increased, reflecting poor management.

How to Increase Availability

Mention should be made of several ways in which availability can be increased tremendously, and yet at relatively low cost. Ask mechanical officers on roads that have steam locomotives making over 20,000 miles per month what contributes primarily to these records. Nine times out of ten the man you ask will say, "roller bearings and extended mechanical lubrication." The availability of a locomotive equipped with roller bearings will be increased 50 per cent. Roller bearing parts on driving wheels have a life expectancy of 500,000 miles. Compare this with the 30,000-40,000 mile life of crown brasses and hub liners in conventional friction bearing locomotives. Other advantages of roller bearings which contribute to availability are greater accuracy in the alignment of driving axles and the elimination of excessive lateral. As a result, rod bearing life can be doubled, pins require less frequent replacement, and there is reduced racking of the frame, boiler bracing and piping.

Extending mechanical lubrication to crosshead and valve guides, engine and trailer truck pedestals, the stoker, shoes, wedges, and hubs is a simple matter and well worth the cost when one considers the accompanying gain in reliability and decrease in maintenance. In their efforts to better utilize present power, mechanical officers should certainly plan to extend mechanical lubrication.

Keeping Boiler Work Down

Another practice greatly influencing availability, but probably more costly than those already mentioned, is proper boiler feedwater treatment. Adequate treatment reduces scale accumulations on tubes and staybolts, lengthening the life of these elements and necessitating less frequent replacement. A still more important bearing of water treatment on availability is that a locomotive can operate the full thirty days between required boiler washings, and not be adversely affected by too high concentrations of dissolved salts. An idea of the increased availability resulting from proper feedwater treatment can be gained from these reports. On one line where washouts were required every seven to ten days, locomotives now go the full thirty days before they are washed, giving no trouble from carryover. Flue renewals, formerly required every two years, are now made every four years. Another road which found it necessary to wash boilers every four or five days now finds that with better water conditions, washing is necessary only every thirty days.

The ultimate in availablility would seem to exist if the only work necessary at the turning point were inspection, lubrication, taking fuel, water and supplies. Is this unattainable? Yet it must be the goal of the mechanical officer.

To obtain rapid turning, repair work must be kept to a minimum. How can this be done? An analysis of data available in 1935 shows that boiler repairs amounted to 30 per cent of total locomotive repairs, with a major portion of this cost due to the firebox and its thousands of staybolts. Following are several practices which with minimum cost will greatly decrease boiler repairs and thus increase availability.

Seal welding staybolts seems to be an answer to leaky staybolts, prolonging the life of firebox sheets as well. One road found that the use of top boiler checks equipped with a spray nozzle contributed substantially to the ability of one locomotive to run over 175,000 miles without trouble from leaky staybolts. Leaky seams and staybolts will result from rapid temperature changes experienced during firing-up or running with the firedoor open. The installation of a circulation nozzle for use during firing-up will eliminate stratification of water and help to ease the excessive temperature changes. Firemen should be cautioned against indiscriminately opening the firedoor. Some types of feedwater heaters can be used to fill the boiler while the locomotive is standing but, as no exhaust steam is available, the impact of cold water on the hot boiler will have a very harmful effect. Mechanical officers must stress proper firing and boiler feeding practices, and see that instructions concerning them are obeyed.

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Why Have Better Utilization?

In talking of utilization, let us answer the question of why have better utilization. Assume a railroad has 1,000 locomotives on its roster. If by proper utilization this railroad can give adequate service with 900 locomotives, just imagine the savings in capital investment, taxes, and interest. Repair costs per locomotive may increase, but this is offset by having to repair one-tenth fewer locomotives. Also, many inspections and repairs are required on the time basis. Better utilization with increased mileages between these periodic inspections makes for lower repair costs per mile.

Some have suggested increasing utilization by cutting down lost time on the road. Practices that will achieve this are: concentration of fueling, water, sanding and fire-cleaning facilities at one spot so that for complete servicing a locomotive needs to be spotted only once rather than three or four times. High capacity water cranes and coal delivery chutes are indispensable. Roads dispatching most of their passenger trains in one short period should see that these trains are not delayed at servicing points. Perhaps due to an inadequate servicing or inspection force a following train will have to wait five to ten minutes for a leading train to pull out of a servicing stop. Such delays must be remedied.

Discussions of utilization have rarely mentioned improving utilization of locomotives in freight or branch line service. On mainlines where the density of traffic is higher, it is usually possible to dispatch a locomotive soon after it has been turned. On branch lines the problem of dispatching a locomotive without delay will necessitate close cooperation between officers in the mechanical and operating departments. Each division has its own particular problems. For example, at a division point on one road where a short helper run was necessary, if an inbound train came in shortly before an outbound train was scheduled to depart, the inbound locomotive was sent out as helper before being turned. Contact the men in the operating department *now* to see where the two of you can cooperate to obtain better utilization.

Railroads with exceptional records in locomotive miles per day have many extended runs. Maybe extended runs are not the solution of your problems. But don't discard the idea just because your maintenance personnel are accustomed to changing engines at every division point. Maintenance problems arise with extended runs, but these are capable of solution. One railroad, especially successful in organizing extended runs, handled maintenance in the following way. Locomotives in extended run service are assigned to a maintenance terminal where repairs and monthly inspections are made. Terminals enroute only service and make minor repairs to these engines.

Reliability a Necessity

Reliability in operation is a prime necessity. Every road failure should be investigated, following up with measures to prevent similar failure in the future. Have you stopped to consider what percentage of your locomotive failures can be attributed to the human element, to shoddy work? Failures due to inferior methods or sloppy work cannot be tolerated. The remedy for this type of breakdown lies in thoroughly instructing employees in new technical developments. Alert supervisors with rigid inspections will eliminate breakdowns traceable to poor workmanship.

Reliability is a function of simplicity of design. Before mechanical officers order locomotives equipped with new items, he should ask if the benefits derived will balance the loss in simplicity and rise in maintenance. However, it is felt that the refinements previously mentioned, roller bearings, spray type boiler checks, circulation nozzles, and extended mechanical lubrication will meet the test of these questions and so are justifiable.

Start to Work Now

Every mechanical officer is familiar with the above mentioned practices that will give him increased availability and utilization. Every maintenance officer should assume the responsibility of mapping out a program to better the locomotive records of his district *now*. Start to work *now*. Within the next week talk to men on your own road and the mechanical officers of other roads about what should be done to get better utilization and availability. Develop an "increase utilization" plan that includes plans to be carried out for the next several years. Beware, however, that you don't become so enthusiastic in bettering these two characteristics that you sacrifice quality of service. Utilization records will look better if an outbound train is held several hours until a locomotive on an inbound run comes in and can be directly reassigned to the outbound train that has been waiting. But just imagine the accumulated delay if this is done at half a dozen division points. What advantage is extreme utilization if it results in lost traffic?

In mapping out your plan to increase availability, a survey should be made of the time your locomotives spend in terminals. Is that locomotive expeditiously inspected after the engineman leaves it; are there delays in fueling, taking water, and cleaning fires; must it wait for a stall to be cleared in the roundhouse? Analyze any bottlenecks. Some may be difficult to break without large expenditures, but many can be eliminated by better planning. Break those bottlenecks *now*.

Can you expedite classified repairs? For example, one road has developed a paint and grease stripping rack to clean a locomotive before it goes into the shop for repairs. Use of the stripping rack cuts to a fraction the time formerly spent in hand cleaning and paint removal. With study the ingenious mechanical officer can spot other places where repair time can be cut. Consult the men in the shops—the machinists and boilermakers. Their first-hand experience will give you many tips on cutting down the time in shops.

There can be no cut and dried formula to obtain increased utilization and availability. Every division has problems that must be treated separately. The application of the above mentioned practices will help much. What is necessary is for every mechanical officer concerned with locomotive maintenance to analyze all operations under his cognizance to see where they can be improved, and start a campaign to use his motive power more effectively *now*. Do not be deterred by those who make light of your ideas. People are prone to emphasize the bad points in a project, tearing it down, because they themselves did not originate the idea. If you have a practical idea, see that it is given a fair trial. Take steps to better utilization, availability, and reliability *now*.

"Train of Tomorrow" Calling "Queen Elizabeth."—Toward the end of its first press run on May 27, as it was speeding through northern Indiana over the Monon, General Motors' "Train of Tomorrow" was placed in radio communication with the ocean liner "Queen Elizabeth" in mid-Atlantic. The two-way conversations were recorded and re-broadcast over the Mutual network the following day.

Research the Key to Improvement

Second Prize

By E. Vernon Jaramillo*

New and better paths leading to progress in steam locomotive performance can be opened by research investigations

THE best and surest way to obtain the maximum utilization of the steam locomotive is through more research. Research here means a logical and systematic approach to the solution of the individual problems encountered in the performance of a steam locomotive and refers to investigations conducted by scientific men experienced in those specific fields.

In this day and age it is an unwritten law that any large industry which promotes research is destined for success, and conversely, any large industry which disregards it is doomed to failure. As a newcomer to the railroad industry the author is extremely surprised to see that we spend comparatively very little for research. In fact, the railroads are almost parasitic in this respect since they slowly assimilate and utilize the knowledge gained at the expense of the other industries. The only reason the railroads can disregard research to the extent which they do and still manage to survive is because of the tremendous need for heavy transportation which, so far, can only be supplied by "the old iron horse." In reality, however, the railroads are paying for this negligence because it is they who have to pay for the unnecessarily high fuel and maintenance costs.

Traditional railroad conservatism is no doubt responsible for the established policy toward research, and although conservation is usually associated with mature judgment, it is not necessarily the most profitable policy. This becomes quite evident when one looks at the development of some of the other modes of transportation. The airplane is the best example of what a little foresight on the part of a few individuals did forty years ago. Research is almost entirely responsible for making the airplane what it is today. A look at the development of the automobile will also show a similar story. Where would the steam locomotive be today if a similar amount of time, energy, and money had been devoted for its development?

There have been a few railroads who have continually maintained some form of a research program, and these railroads are certainly to be commended for their endeavors and results in this field. Other railroads are just beginning to realize that in order to keep abreast with the higher standards of living some kind of steps must be taken to expedite their progress, and they are now turning to research to show them the way. Most railroads already are utilizing the services of all their personnel to the maximum mutual limits, so they have no alternative but to turn to research for further assistance. This research should not be conducted mostly by railroad men because the proper solution to a problem often involves the knowledge of so many technical men that a single railroad could not possibly afford to engage all their services.

Research on a large scale for the railroads could be handled best by an agency subsidized by several railroads. This agency would allocate the research as it would see fit to universities, research institutes, or private industries depending on where the problem had its best chance for being solved. Such an agency already exists, and it is now on the threshold of developing a new type of motive power, the coal-burning gas-turbine locomotive, which promises to solve many of the railroad's present economic difficulties. The transition period for completely converting over to any new form of locomotion, whether it be Diesel, electric or turbine, would take at least fifteen years, and during this period considerable work could still be done to improve the steam locomotive. The author does not feel, however, that the future will bring a complete end to the steam locomotive. With the advent of atomic energy there is possibility that a means for producing steam safely and economically might soon be forthcoming, and should this ever happen, the steam locomotive might well be here to stay. It can

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Norfolk & Western engine terminal at Williamson, W. Va.

be clearly seen, though, that research is leading the way.

Many will say there is very little room for improvement on the steam locomotive due to its inherently low thermal efficiency. It is granted that a steam engine of any kind under a heavy load is doing well if it has an overall efficiency of 12 percent, but it is hardly good engineering to be satisfied with an efficiency of half this value. A six percent overall efficiency is about the average value for most locomotives, and this figure can surely be raised without adding accessories whose maintenance costs will prohibit their use. It is easy, of course, to prescribe a medicine for the cure, but we must first establish what it is we are going to cure. There are many mechanisms on the present locomotive which can be improved, and the author is going to discuss those which seem to have the most possibilities for producing an economic gain.

The most inefficient device that is found on the steam locomotive today is the exhaust steam nozzle in the front end. It has been shown that this device is about five per cent efficient in converting the energy present in the exhaust steam to movement of the air through the locomotive. The use of an induced draft fan operating from the exhaust steam at a lower back pressure might be the solution to the problem. In the past the principle objection to the use of an induced draft fan was the lack of metals which would withstand the erosion caused by the cinders, and it would, therefore, have a high maintenance cost. Metallurgists have made, however, tremendous strides in developing durable alloys which could now be used in those places where erosion is extremely prevalent. Towards the end of the war Germany was using induced draft fans in many of its latest locomotives, and apparently the maintenance problem had been licked; hence, this idea is already beyond the theoretical stage.

One of the largest heat losses in a lcomotive is the unburned carbon loss, and the majority of this loss is the unburned coal particles or cinders. There have been a few ideas for separating the cinders from the gases in the front end and returning them to the firebox for reburning, but thus far none of them have proven very successful. It seems quite logical to assume, however, that this could be done by using a properly designed centrifugal separator and transporting the cinders by using small steam air jets. This is definitely a problem for research, and also one which holds many unlimited possibilities. Only an intensive research program could determine its feasibility and its practical applications.

The firebox and its accessories provide considerable room for improvement. One of the largest problems encountered in trying to obtain a high combustion efficiency is the problem of proper air distribution. What the answer is in order to obtain a proper air distribution is not entirely clear. It may be the use of air scoops, or perhaps the use of a forced draft fan, but in any case, the railroad which obtains a proper air distribution will have a tremendous savings in fuel. The possibility of overfire air cannot be forgotten. It is well known that over fire steam air jets will decrease the smoke, but they do not seem to add to the efficiency of the locomotive. The basic theory of the mixing of air in the firebox still needs to be developed, and it is entirely possible that once this theory is clearly understood over fire air can be used advantageously.

In the boiler we do not find many places for improvement, but we can always strive for higher steam pressure and temperatures which again is a problem for the metallurgist in developing metals which will withstand these higher temperatures and pressures. The higher steam temperatures will, of course, produce a higher thermal efficiency. Methods for improving the heat transfer could also be investigated since more efficient ways of heat transfer are constantly being developed in other industries.

The topics for research investigations just proposed are merely those which seem to have good possibilities in the near future and are undoubtedly far from complete. It must be remembered that research is comparable to a landslide; it continues to grow in magnitude and tempo after it is once started. What it might bring is unpredictable, but one can always rest assured that it will open many new and profitable paths. To repeat, the best and surest way to obtain the maximum utilization of the steam locomotive is through research.

Other Approaches to Important Locomotive Problems

A variety of worthwhile ideas from the men who gave the prize winners real competition in answering the locomotive question

THE papers submitted as entries in that part of the prize competition dealing with locomotives came from men in railroad jobs ranging from special apprentice to the more important supervisory staff positions and from others associated closely with the mechanical department problems because of business connections. Most of the authors are men who have direct responsibility in making sure that locomotives are ready to go at the time they are marked up for despatchment and every one of them had at least one constructive idea on how to meet the important problem of locomotive maintenance and utilization. Space in this issue will permit the publication of the prize winners and the three papers receiving the next highest ratings. These three papers appear on the following pages and others of the remaining group will be published in later issues.

Cooperation Needed to Boost Steam Power

By working together the railroads and the satellite industries can improve steam locomotive utilization for the common good

By Fred D. Mosher and John J. Kane, Jr.,
Research engineer and test engineer, respectively, Standard Stoker Company, Inc., Erie, Pa.

The sincere critics of railroad operation often get sidetracked with respect to constructive suggestions because the basic reasons for a railroad's existence is overlooked. This basic reason is the same as is true for any other form of private enterprise—providing an adequate service in such a way that a reasonable profit will be returned to the owners. This is a fundamental for all business operating in a free enterprise system such as ours.

In a manufacturing plant such items as clean employee facilities, modern lighting, adequate heating, good housekeeping and standard rates of pay mean nothing unless the tools with which the product is turned out are modern and kept in top operating condition. The popular writing school which clamors for new cars, air conditioning, and other conveniences for the traveller or shipper must, because of lack of knowledge, overlook the function of the production tools(motive power and its adjuncts) and consequently the public becomes misinformed about its rail transportation systems.

The very heart of rail transportation is steam motive power; if it is not operated efficiently no amount of frills added to its environment will improve its earning capacity or its usefulness. And one of the most important considerations in locomotive utilization is the extent of cooperative effort that is made available to meet this objective in a high degree.

Take Advantage of Others Experience

Locomotives must be designed for the job to be done. Here is where cooperatition within the industry can be implemented to incorporate features that are known to be desirable. From its inception the design and building of locomotives has been art unassisted, in many instances, by advances made in engineering. There must never by any compromise with safety of operation but all too often, where an art is concerned, the old continues where the new ought to be given precedence. In the design of modern steam locomotives individual railroads have made remarkable strides but other systems quite frequently fail to take advantage of the experience. This failure hampers, in the long run, the general advance of the steam motive power field. The machine must be made better at minumum costs and it would be well to concede some of the art to engineering. Advantages to be obtained would be a wider disemmination of sound engineering knowledge and a standardization of steam motive power flexible enough to meet the various requirements of the major railroads. Neither pride of creation nor unique requirements should stand in the way of producing units of steam motive power that could provide lower unit costs in the production of transportation.

Research Organizations Are Available

Both the Steam Locomotive Research Institute, Inc., and the A.A.R. committee for further improvement of the steam locomotive are appropriate agencies for coordinating efforts in the direction of standard designs. Both of these organizations are staffed for advisory work and for active research leading to the establishment of necessary standards. Efforts in the past intending to reach agreements have failed for reasons too involved for this discussion.

Stricter attention to available coals must be given when future locomotive designs are considered. Bituminous Coal Research, Inc., a rapidly growing organization, can render a real service to the railroads by furnishing information on fuel. The motive power committee of the parent organization is actively engaged in a number of research projects having as their objective the improvement of existing steam locomotives. By effecting a closer liason with the motive power departments of the major railroads better designs for future steam power can become an actuality. To accomplish this, perogatives, real or imaginary, may have to be given less weight and the ultimate correct answer ought to be given precedence over other considerations.

Reasonable standardization in steam locomotive design would facilitate shop work with respect to maintenance because standard methods for repairs could be developed industry-wide rather than for individual railroads. In no other industry do maintenance costs vary so widely as in the field of steam locomotive maintenance. A study of maintenance practice will indicate quickly how almost utterly impossible it would be to exchange ideas profitably because of existing conditions as to shop facilities, equipment, and personnel.

The basic function of providing transportation often becomes so complex in itself that important secondary considerations such as maintenance must be given the go-by insofar as the attention of major executives is concerned. Cooperation between various departments is a must if effective maintenance programs are to be carried out.

In the railroad field, as in no other, there is a large group of satellite industries, depending, for their continuing existence, on the prosperity of the carriers. Those satellite industries can make very great contributions to the improvements of steam motive power all the way from design to operation. Participation of railroad supply companies in the program of Bituminous Coal Research, Inc., would increase the scope of this organization; active cooperation between motive power departments and the agency could produce beneficial results in the form of improved locomotive utilization and consequently lower transportation costs.

The operation of steam locomotives cannot be compared to any other industrial activity, but leaves taken from other books can improve this function. It is axiomatic that a business can be no better than the personnel who run it. With new conditions being imposed upon rail transportation, and with attendant increasing costs, the training of personnel becomes more and more important. It is incorrect to assume that personnel trained in old methods cannot be restrained for the new. And new methods of training must be introduced as was demonstrated in manufacturing industries during the recent

war period. New mental and physical tools must be provided to keep pace with rising costs. In some instances highly developed training programs have been organized by railroads and through industry cooperation the benefits can be passed on to those who do not now have such activities.

Servicing Facilities Need Overhauling

Operating conditions on railroads continue to change with faster operating schedules and in many cases existing facilities for fueling and other locomotive services quickly become inadequate or costly. Coal handling is an important service function that requires constant planning. In too many instances present coaling stations are unsatisfactory for good locomotive performance. But here is a problem that cannot easily be solved by the railroad itself when its key personnel is concerned with so many other vital matters. A logical function of group effort on the part of the railroads and the coal industry would be to impartially study existing coaling facilities and recommend changes that would eliminate many of the present attendant delays in train movement .

Along with the problem of fuel handling goes the problem of ash removal from locomotives. Too little thought has been given to this problem, again because of other pressing problems concerned with train movement. Cooperative study of the problem, by pooling of ideas, would uncover some of the problems and ultimately provide solutions which would improve the handling of ash.

One Result of Cooperative Effort

Through Bituminous Coal Research the coal producers are actively engaged in a study of coal for locomotives. A proper answer to this question will do much to reduce transportation costs through improved utilization.

Better fuel performance will require continued joint research by the railroads and the interested industries and agencies in the field of coal combustion. Progress is already being made and some of the fruits of Bituminous Coal Research activity have become available. Of recent accomplishment is the completion of a thorough study of air distribution to locomotive grates and through fuel beds. The development of the undergrate air distributor is an excellent example of cooperation between those interested in improving fuel performance in coal-burning steam locomotives and those who use the locomotives. The research would not have been possible if the cooperative effort were lacking. As a result of the work the railroads have available another simple device which will improve locomotive operation.

If progress is to continue at an accelerated pace in the field of steam locomotive performance there must be cooperation all down the line from designer to operator. In order to obtain the greatest benefit the industry surrounding the railroads, and depending upon them, and the railroads themselves must work for closer and closer cooperation so that the end result will be improved steam locomotive utilization for the common good.

Keeping Locomotives in Circulation

Four-point program suggests the introduction of new ideas, that better methods, the training of employees, standardization and scheduled maintenance comprise the key to the problem of locomotive utilization

By Herman C. Whitacre

Assistant Enginehouse Foreman, Spokane, Portland & Seattle, Vancouver, Washington

The problem of outstanding importance with respect to the maintenance and utilization of locomotives is to keep them moving. A thousand dollar bill has no value unless it is being used in the manner and purpose for which it is created. Likewise, a locomotive in the shop for repairs or a car on a siding has a value wholly determined by its possibilities in becoming active and thus fulfilling the purpose for which it was made. The locomotive and car that are in motion are the ones that make our pay checks possible. Since this is true beyond question, our problem as railway men is to keep them moving.

There are but two important components to our subject. First, there must be goods and commodities to be shipped out; secondly, we must have cars and locomotives available to make up trains for this shipping. It is every railroad man's privilege and duty to be a booster for the industry which provides him with a livelihood and the good things of life. He should be, literally, a salesman for the railroad and should never pass an opportunity to act in such a capacity. The shop man's first interest, however, is with the second part of the problem; that is, in furnishing the locomotives and cars. If there are goods to be shipped by rail and locomotives and cars with nearly one-hundred per cent availability, then indeed, the railroad men will be prosperous.

All mechanical equipment is subject to wear, breakdowns and accidents. In addition, certain periodic inspections, tests and repairs of defects are required by our government for the purpose of promoting safety for the employee and the public. These happenings, of necessity, involve the use of valuable time. Our problem, then, is to take care of these delaying factors with a minimum of hindrance to the moving train.

Devise New Methods

First in consideration as a time saver would be the corrections made as a result of a general survey of methods, conditions and schedules now in use at each particular location. A concentrated effort should be made by every employee to report and devise new ways of doing things, suggested shortcuts and new ideas. You and I know of many shops that are making repairs in the same manner that our grandfathers made them. This gathering of ideas can be managed in several different ways, each of which I am sure will have a grand result. The good ideas can be readily separated from the crackpot suggestions and placed in effect immediately, saved

for the future or discarded entirely. The man actually doing the job, when encouraged to do a faster, better job in an easier manner, will generally become more interested and will do a better job even though he may not suggest an easier method. Above all, a mechanic should never be criticized for being lazy because he has devised an easier way to do any operation. This first suggestion is one in which we can all have a part.

Raise the Morale

Second in consideration, but very important in any shop, is the morale of the man doing the work. Entirely upon him will depend whether you "keep them moving" or whether "next week is soon enough." The average railroad man is a good citizen, a good family man and, I believe, above the average in education and intelligence. Each day he expects and wants to do a good day's work.

Every shop has more men with ten years' seniority than men with lesser years of service. With this background, there is no reason why each and every employee should not be a loyal, wide-awake, enthusiastic booster for his job and his company. But this is generally not true and a great part of the fault lies with the management. A great many books have been written about management and employee relations but it all boils down to the fact that every employee wants to be appreciated, to have a kindly word and a knowledge that he is important in the great job of keeping them moving.

Train and Educate the Employees

Closely allied with the morale of the men of our railroad shops is the training program for the employees who are maintaining and operating our locomotives and cars. It is true that the power of the atomic bomb has always existed but, through training and schooling, man has discovered the method of assembling this great force. Just so, the men of our railroads are capable, with training and experience, of accomplishing great things. It is the problem of the management to train and encourage the education of their employees. Railroad leaders would certainly not encourage the use of a dull chisel, below par boiler steel, or a defective brake valve but they will suffer a mechanic employee to be below par in his knowledge and ability for all his railroad years. A railroad company will spend a half-million dollars for new power capable of doing a good job of keeping them moving and then give this wonderful piece of machinery to the highest seniority bidder for operation solely because of his position on the seniority roster.

I believe the railroad company should no longer be indifferent in its interest in the education of its employees. Every shop should compel its apprentices to pass periodic inspections and examinations. Lack of interest, poor grades and any other just reason should be cause for dismissal from the service. Railroad companies should sponsor clubs or schools for their employees in which lectures, moving pictures and safety first programs are given. Railroading is a great job and every employee should be justly proud that he has earned the right to be a member of this great family. If he does not feel in this manner, there is but one of two parties at fault, the employee or the employer. Man is the keenest, the most accurate and the most versatile machine used in railroading. If he is educated, trained properly and treated rightly, he will certainly be a great factor in time saving and in keeping them moving.

Schedule Work and Standardize Parts

Third in consideration is the actual maintenance and the regular end-of-trip daily repairs. No reported defect should be left undone, for small defects have a way of growing into large ones and it is always cheaper both in time and money to take care of the small jobs now. Very definitely, do not save a job for a later date or for "tomorrow" for "tomorrow" never comes. Each new day will always bring troubles of its own. Some railroads save work for the day of inspection and "put it off" until that date with the excuse that it can be done more easily at that time. This is a fallacy and should never be encouraged. Never sacrifice quality for quantity. A poor job done is another way of making sure that it will have to be done again with a resulting loss of valuable time.

The larger defects and accident repairs require more man-hours. These can best be handled by having duplicate parts which can be readily substituted for the defective parts.

A word should be said at this time about standardizing locomotive parts. The size and weight of locomotives must be taken into consideration but there is no reason for having a different size bolt or spring-rigging pin for each position on a locomotive. The larger size could be used for all positions and the cost of maintenance would easily overcome the extra cost of material and production. These parts can be carried in stock by the store department. More and more parts of locomotives can be standardized if an actual effort is made in this direction. Engine trucks, complete sets of rods, crossheads, complete locomotive tanks, a pair of roller bearing driving wheels, tank trucks and many other packaged parts ready to go should be available to the roundhouse foreman. In general, the time-saving element in a heavy repair or accident job is to have packaged spare parts for ready substitution. Repairs can be made to the damaged part after the locomotive is back in service.

Organize for Inspections and Repairs

My last and fourth suggestion is in regard to the necessary time given to the periodic inspections and repair of defects found as instructed by the rules of the Interstate Commerce Commission. There can be no shortcuts in the inspections and repair of defects found but there can be an efficiency of organization within the shop which will lessen the amount of time required.

Most railroads use their power until the last day allowed and I believe this to be a mistake. Inspection dates can be so anticipated and planned that the locomotives can be held out of service at a time when they are least needed. Our I.C.C. rules give us the maximum elasped time between inspections and suggest that this time may be lessened if so desired or becomes necessary. It is not always desirable to wait until the inspection is a "must do" for often that is the day the engine may be badly needed.

The number of inspections, with its repairs of defects found, is great enough in most shops to keep a trained crew busy on this one class of work. Any mechanic will eventually become proficient through repetition for this is the way of doing a good job. He will accumulate and secure special tools because these will also make his job easier. Inspection crews should be encouraged in every effort made which will result in saving time. If the defects shown on daily work reports have been properly repaired, it should not be necessary to make many repairs other than those disclosed by the special work required of an inspection. To sum up the necessary time for inspections: plan the inspections for a time when the engine is least needed within the limit set by the I.C.C. rules, and have a specialized crew do the inspection and repair defects found.

Summary

In conclusion, the problem of outstanding importance with respect to the maintenance and utilization of loco-

motives and cars is to "keep them moving." Each and every railroad shop can increase the availability of their locomotives by:

(1)—Management and employees taking an inventory of past practices schedules, conditions and methods with a view to increasing efficiency and saving time.

(2)—Bettering the morale of all employees in the belief that happy, satisfied employees make better workers. Training and education of all employees; a sharp tool is always better than a dull one.

(3—Doing maintenance work now. Never sacrifice quality for quantity; standardize parts and have packaged parts available to substitute for defective ones.

(4)—Plan for I.C.C. inspections and do not wait for a "must"; repair of defects found with specialized crew.

All of these suggestions can be fully used by every shop, be it large or small, without regard to government priority or restrictions. This is a "help yourself" program and should aid in solving our big problem of "keep them moving."

Select the Right Materials for the Job

Maintenance costs will decrease and utilization will increase if laboratory tests prove that the materials meet the specifications

By J. W. Cameron
Engineer of tests, Wheeling & Lake Erie

What is the problem of outstanding importance with respect to the maintenance and utilization of locomotives and what is considered the best way to meet it? A locomotive is a machine for doing work, designed and built with a certain maximum overall efficiency. To keep the locomotive operating at that efficiency means providing proper maintenance in the roundhouse and the locomotive shop. To provide proper maintenance, means thorough inspection, skillful workmanship and the use of good materials. Although the problem of obtaining good inspection and workmanship is of prime importance, it is a long range project, dealing with the selection and training of personnel to perform certain duties and work in the most skillful manner. To the writer, the materials used in the maintenance and operation of locomotives presents the problem of outstanding importance. If materials are used in the structure and machinery and in the operation of locomotives that are known to meet certain specifications or standards, maintenance costs will decrease and utilization will increase. The best way to meet this problem is to set up a laboratory manned with a capable and adequate staff of technicians to test and analyze the materials.

The Materials to Be Analyzed

Under materials there are two categories that affect maintenance and utilization. The first group includes the materials that go into the structure and machinery of the locomotive. The second group includes the materials that are used in the operation of locomotives. Under the former are the following important materials: (1)—Steel plates, shapes, bars and castings; (2)—axles, wheels and tires; (3)—forging steel; (4)—tubes and flues; (5)—rivets and welding wire; (6)—wrought and cast iron; (7)—non-ferrous materials, and (8)—special equipment. Under the operational materials are the following: (1)—Water; (2)—fuel, and (3)—lubricants.

Before setting down any proposed program for insuring the use of good materials, the writer would like to state that the cost of providing the means of testing and analyzing, is not being overlooked. A rather complete program is outlined in this paper to give an overall picture of the possibilities of the laboratory in the maintenance and utilization of motive power. Although some of the savings effected by the laboratory investigations are direct and can be actually shown, most savings are indirect and intangible. The size of the railroad, the amount of new materials purchased or manufactured and the number of motive power units in use establish the limit as to how much can be invested in such a department.

This department, hereinafter called the laboratory, should be incorporated in the maintenance and equipment department under the head of that department. Certain methods and practices have to be established between the purchasing department, locomotive shop and engine house, to be in accord on what materials are to be tested and the conditions of acceptance or rejection of these materials. The laboratory should work with the car department and maintenance of way department in testing such materials as deemed necessary. The head of the laboratory would have under his jurisdiction the chemical, metallurgical and physical laboratories.

To describe fully the operations and methods used in the three branches of the laboratory would in itself make enough copy for another paper. The objective of this paper is to show how the laboratory, by its methods and operations, can reduce maintenance and increase utilization of motive power.

What Feedwater Treatment Will Do

Considering water, one of the operational materials first, adequate treatment and control of all boiler feedwater by the laboratory pays large dividends. The importance of good non-scaling, non-corrosive fedwater and the means and facilities for obtaining and controlling such water should be given first consideration. When water stations have been established throughout the railroad system and the facilities installed to adequately treat the water, then a system of control through the laboratory should be set up to maintain all water supplies at the desired treatment. Certain concerns that manufacture and sell water treating chemicals offer reliable service in helping to establish and maintain a good system of water control. When washout periods can be extended to thirty days, when flue extensions can be run to five years, when fireboxes can be stopped leaking, when overheating of sheets can be eliminated and scaling can be reduced to a minimum or corrosion stopped entirely, the savings effected more than warrant the cost of the laboratory control.

Make Fuels Meet Specifications

The second of the operational materials, fuel, which includes coal, fuel oil for steam locomotives and Diesel fuel oil, is very important when considering maintenance and utilization. Laboratory analyses of these materials insures the user that he is geting fuel to specifications and if these specifications have been tested and proved to provide a fuel that will give efficient performance, then maintenance costs are further reduced. When plugging, honeycombing and undercutting of flues are eliminated, when steaming qualities improve, when plugging of fuel filters and injector systems is eliminated, when carbon deposits are reduced to a minimum, when the efficiency of engine performance increases, the importance of laboratory analysis is indeterminable.

Lubrication to Meet the Conditions

Lubrication of the moving parts of locomotives is also of prime importance. Lubricants used should be carefully selected to provide the proper lubrication under the conditions that exist. Laboratory analyses will show if lubricants as specified are being furnished by the supplier. Valve oil, roller bearing oil, Diesel crankcase oil, machine oil, car oil, journal grease, rod grease, brake cylinder lubricant, gear compounds, are lubricants that should be carefully selected and analyzed. Reduced maintenance will be effected by longer life of valve and piston rings, cylinder and valve bushings, roller-bearing connecting-rod crankshaft bearings, cylinder liners, Diesel piston rings, camshafts and bearings, journal and rod brasses, crown brasses, brake cylinders and pistons, Diesel driving pinions and gears.

Insures Structural Materials Up to Standard

Materials that go into the structure and machinery of the locomotive should be given due consideration. The metallurgical and physical laboratories play their parts in determining if the materials on the locomotive, or to be put on, meet the specifications as provided. The metallurgist can determine by microscopic or macroscopic examination, the grain structure, the presence of defects, the constituents of the metal, the effects of heat treatment and working stresses. In the physical laboratory, tensile, compression, bend and other fatigue tests can be made to determine the physical properties of the materials. When it is known that materials, such as firebox and boiler steel, structural shapes, bars and castings, wheels, axles, tires, forging steel, rivets, welding wire and non-ferrous materials that go to make up a locomotive, meet certain standards, these materials should hold up in service if the designing is correct and operating conditions are normal. Working with these two branches of the laboratory, an inspection department of the locomotive shop, using magnetic particle inspection, can remove from service all defective materials found. By examination and testing these defective parts the laboratory can determine the reasons for failure and recommend either improvements and repairs or the scrapping of the parts.

With the laboratory set up as described, with additional personnel to handle the work, other departments of the railroad could benefit from various material analyses. Work also could be done in various fields of railroad research. The potential value of the laboratory, once it is established, is large.

To summarize, let us consider what the difference between good and bad water means in boiler maintenance and Diesel cooling water system maintenance, what good fuel means in efficency of operations, what good lubrication means in machinery maintenance, what dependable structure and machinery means to utilization. Then we can say that the problem of outstanding importance with respect to maintenance and utilization of locomotives, is the selection of materials. This problem can be met in the laboratory.

* * *

Atchison, Topeka & Santa Fe facilities at Barstow, Calif.

ELECTRICAL SECTION

Generation and Use of

Power for Passenger Cars*

By Hugo H. Hanft†

Some relative factual data on the different types of passenger car power supply indicating the advantages of its generation by means of internal combustion engines

THE generation and utilization of electrical energy on railroad passenger cars impose no complex engineering problems. Several basic systems have been developed during the past forty years. Others have been tried out experimentally, and still others have reached the advanced design stage. No one system is to be preferred fundamentally over all others. Each system has certain operating advantages, and none is free from features that handicap operation.

Increasing car electrical loads suggest careful scrutiny of the several factors inherent in any car electrical system. Particular attention should be directed to: (1) Reliability; (2) Maintenance requirements; (3) Equipment weight; (4) Power demand on the locomotive.

Car electrical equipment on a railroad passenger train falls into three classifications: (1) Prime power source; (2) Electric energy storage; (3) Energy utilization devices.

The various car power systems now in use, and proposed for the future, employ several variations in each of the foregoing equipment classifications.

Early History

Electric power first was applied to railroad passenger cars about 1905. Earlier cars were lighted by gasoline, kerosene or Pintsch gas lamps. Then, a few small incandescent lamps were introduced for lighting. They were served by small storage batteries carried under the car. The connected load drew about 20 amps. at 30 volts. The battery was charged by a 2 kw., 40-volt, d.c. generator mounted under the car, and driven by a flat belt from a pulley on a car axle.

Connected loads grew gradually until the mid 1930's, when the introduction of air conditioning necessitated far greater generator and battery capacity.

Ice-Activated Air Conditioning

Some of the earlier air conditioning equipments were ice-activated, depending for cooling upon the ice carried in under-car bunkers. A full charge consisted of sixteen 300-lb. cakes of ice, sufficient for about 8 hours of maximum cooling effect. As the ice melted, electrically-operated pumps circulated ice water through an overhead finned cooling coil. An electric blower forced air over the cooling coil, and into the passenger space. Water returning to the under-car bunker was sprayed over the ice, hastening melting, and increasing cooling capacity.

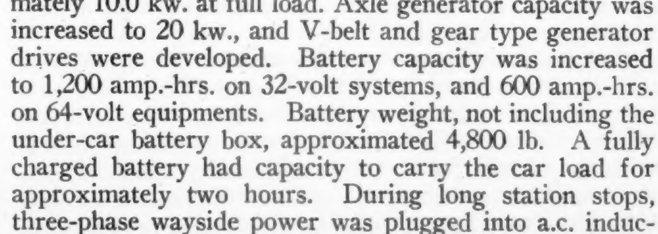
The ice-activated system required extensive icing facilities, and was not too effective in reducing excessive humidity in the car.

Electro-Mechanical Air Conditioning

Many of the shortcomings of the ice-activated system were overcome by development of electro-mechanical air conditioning, at the cost of greatly increased electric power consumption.

The early equipments consisted of d.c. refrigerant compressor motors rated at 10 to 12 hp., drawing approximately 10.0 kw. at full load. Axle generator capacity was increased to 20 kw., and V-belt and gear type generator drives were developed. Battery capacity was increased to 1,200 amp.-hrs. on 32-volt systems, and 600 amp.-hrs. on 64-volt equipments. Battery weight, not including the under-car battery box, approximated 4,800 lb. A fully charged battery had capacity to carry the car load for approximately two hours. During long station stops, three-phase wayside power was plugged into a.c. induction motors mounted on the axle generator shaft, carrying the car electrical load at standstill, with some excess generator capacity available for battery charging.

Car electrical loads were increasing rapidly.



Effect of axle generator drag on traction horsepower (eighteen 60-ton cars, three 2-kw., fifteen 30-kw. generators, Davis train resistance)

* Paper presented before the Northeastern District Meeting of the American Institute of Electrical Engineers at Worcester, Mass., on April 23, 1947.

† Transportation Engineer, Westinghouse Electric Corporation, East Pittsburgh, Pa.

The advent of fluorescent lighting, a.c. shaver outlets, water coolers, and room type ventilating fans, called for rotating units to convert d.c. to a.c. for use on the car. The electrical load on one large order of modern passenger cars placed last fall is distributed as follows:

Air conditioning compressor	10.40 kw.
Car air circulating fan	1.45 kw.
Air pre-cleaner fan	.60 kw.
Evaporative condenser pump	.33 kw.
Evaporative condenser fan	.60 kw.
Exhaust fans	.20 kw.
Rotating inverter for lights, water cooler, fans	6.25 kw.
Control	.30 kw.
	20.13 kw.

In order to carry this connected load for a reasonable period of time at low speeds, or at standstill, battery size, was increased to 57 cells, weighing more than 9,500 lb. Axle generator capacity to carry connected load, and care for battery charging was increased to 30 kw. These cars are scheduled to operate in 18-car, fixed-consist trains.

When axle generators are delivering full rated output, they impose a serious drain on locomotive hauling capacity. An 18-car train, with three head-end cars, (baggage, express, mail) has a rated axle generator output of 456 kw., two kw. for each head-end car, and 30 kw. for each passenger-occupied car. Converting kw. to horsepower, and allowing for 95 per cent drive efficiency, and 85 per cent generator efficiency the power taken from the locomotive drawbar to carry axle generator load totals 757 hp. The following illustration shows the effect of this axle generator drain on train performance.

The lower curve shows locomotive drawbar horsepower required to haul an 18-car train on level tangent track, at various speeds, with no axle generator load. The upper curve shows what happens when the 757 hp. axle generator load is imposed. The generators cut in at 16 m.p.h., and achieve full rated output at 25 m.p.h. With no axle generator load, the 18-car train can be hauled at 55 m.p.h., with an expenditure of 1,100 locomotive drawbar hp. The same 1,100 drawbar hp., carrying full axle generator load, can haul the train at only 25 m.p.h.

The same train, with axle generators delivering rated output, can be hauled at 60 m.p.h. with a power expenditure of 2,000 hp. at the locomotive drawbar. Train speed increases to 75 m.p.h., if the generator load is dropped. At 90 m.p.h., the corresponding speed increase is 9 m.p.h., or 10 per cent, with 3,750 hp. at the locomotive drawbar. The net adverse effect of axle generator drag is reduced somewhat by grades and curves.

Cars powered by axle generators and batteries are self-contained. They can be mixed in trains with other cars, and operate independently of adjacent cars. In trains of similarly-powered cars, electrical circuits can be train-lined, providing partial electrical service, in the event of generator or battery failure. Such cars, however, impose a severe drain on locomotive output, necessitating larger motive power if scheduled speeds are to be maintained. The weight and space requirements of batteries present a problem, and in low voltage systems, the weight of cable and conduit alone approaches 2,500 lb.

Steam Jet Air Conditioning

One self-contained car power system, designed to reduce axle generator drag, employs a steam jet system to provide refrigeration. Elimination of the air conditioning compressor load, makes possible the use of a 10-kw. axle generator and a 4,000 lb., 16-cell storage battery, to carry the remaining electrical load. Axle generator drag on the locomotive is reduced by nearly two-thirds, with consequent increase in train speed at any given drawbar horsepower.

Part of this gain, however, is lost in the steam drawn from the locomotive boiler to operate the steam ejector cooling equipment. The limiting factor on steam locomotive horsepower is boiler capacity. Steam consumption on hot days varies from 230 to 260 lb. hourly per cooled car. Drain on the boiler totals around 3,750 lb. of steam per hour for 15 cars. Steam consumption varies from 20 to 24 lb. per rail hp-hr. Taking a mean figure of 22 lb., the steam jet system requires 170 locomotive hp. for operation, approximately half the gain made by reducing axle generator capacity to 10 kw.

The steam jet system is self-contained and depends for power only on the steam trainline, which is carried on the cars for winter heating. The weight of cable and conduit is materially less than that on straight axle generator-powered cars with d. c. electro-mechanical air conditioning.

Self-Contained Gas Engine-Powered Car

Another current method of powering passenger cars involves use of two internal combustion engines operating on compressed hydro-carbon gas carried in cylinders under the car.

One engine drives a belted or direct-connected refrigerant compressor to supply cooling on the car. A second engine drives a 7½ or 10-kw., d.c. generator, carrying electrical load, and charging a smaller, lighter, 400 amp.-hr., 16-cell battery. Cooling equipment is relatively heavy, and weight of cable and conduit is comparable to that of the steam jet system. The car is self-contained and does not depend on wayside power, or motion of the car to keep the battery charged. Fuel cylinders must be replenished frequently, and weigh a total of about 2,750 lb., full, including under-car fuel cabinets. Such cars are steam heated in cold weather, consuming about 250 lb. of steam hourly.

Self-Contained A.C. Powered Car

Several cars have been equipped with small Diesel engines driving 3-phase, a.c. generators supplying power to drive all car electrical equipment. One such car operated in the mid-west last summer and fall.

The prime power source was a 35 hp., 6-cylinder, 1,800 r.p.m. Diesel engine driving a 30 kva., 3-phase, 220-volt a.c. generator. Battery size was reduced to 16 cells rated 176 amp.-hrs., with a total weight of only 728 lb. The battery served to crank the Diesel engine, and to carry emergency lights. It was charged by Selenium rectifiers served through transformers connected across the generator output leads.

A second rectifier was energized by current transformers connected in the generator output leads. The output from this rectifier fed an auxiliary generator field which increased generator excitation with increasing generator load, maintaining good voltage regulation at all generator loads.

Brushless induction motors drove all rotating equipment on the car, with the sole exception of the d.c. engine cranking motor. The two 5-hp. refrigerant compressor motors were hermetically sealed, eliminating shaft seals, belts, pulleys and couplings. The water cooler motor likewise was hermetically sealed. Fluorescent lights were served directly from the a.c. power leads, eliminating a rotating conversion device.

The electrical load on the car imposed no drain on locomotive power. The small battery was kept fully charged without recourse to wayside power, and substantial weight economy was realized on battery, cable and conduit.

Such an equipment can be arranged for trainline oper-

ation of electrical equipment. In the event an engine or generator fails, controls automatically drop half the electrical load on each of two adjacent cars, and one engine generator carries partial load on each of the cars until the defective car can be set out at a division point.

In cold weather the car is heated by circulating hot engine jacket water through finned floor heat radiation. Electric strip heaters in the overhead car air duct supply additional heat, and load the engine to assure maximum heat transfer to the jacket water heating system.

Not only does the Diesel generator equipment eliminate axle generator drag; it also conserves locomotive steam during the heating season.

Head End Power

The four basic car power systems discussed are self-contained electrically. They may be mixed in trains of cars having different electrical power supply and utilization equipment. Some of them are independent of car motion and wayside power facilities. A fifth type of equipment depends on a source of power carried at the head end of the train, and a power transmission line carried on each car. All cars in the train must be similarly equipped.

As early as 1914, one midwestern railroad carried a 125-volt d.c. generator in a baggege car at the head end of the train. The generator was driven by a vertical steam engine, and exhaust steam was used to heat the train. Insulated wires carried power from car to car. Trouble frequently occurred with generator brushes, engine governor and defective wiring.

Shortly before the Second World War, a four-car Diesel-powered train was placed in service, utilizing the motive unit for electric operation of electrical equipment on cars, and for booster heating of cars with electric strip heaters. An eastern railroad is equipping numerous locomotives with steam turbine-generators to supply a.c. power to fixed-consist passenger trains.

Last summer, another eastern railroad seriously considered application of a.c. all-electric power and heating to more than a hundred cars purchased for use in six new 18-car trains.

Each train was to carry two 1,000 hp. Diesel engine generators in a 300,000 lb power car at the head end of the train. Each generator was rated at 650 kw., 3-phase, 480 volts. A single generator had sufficient capacity to carry full train electrical load in all but the coldest weather, the other unit normally serving as a standby.

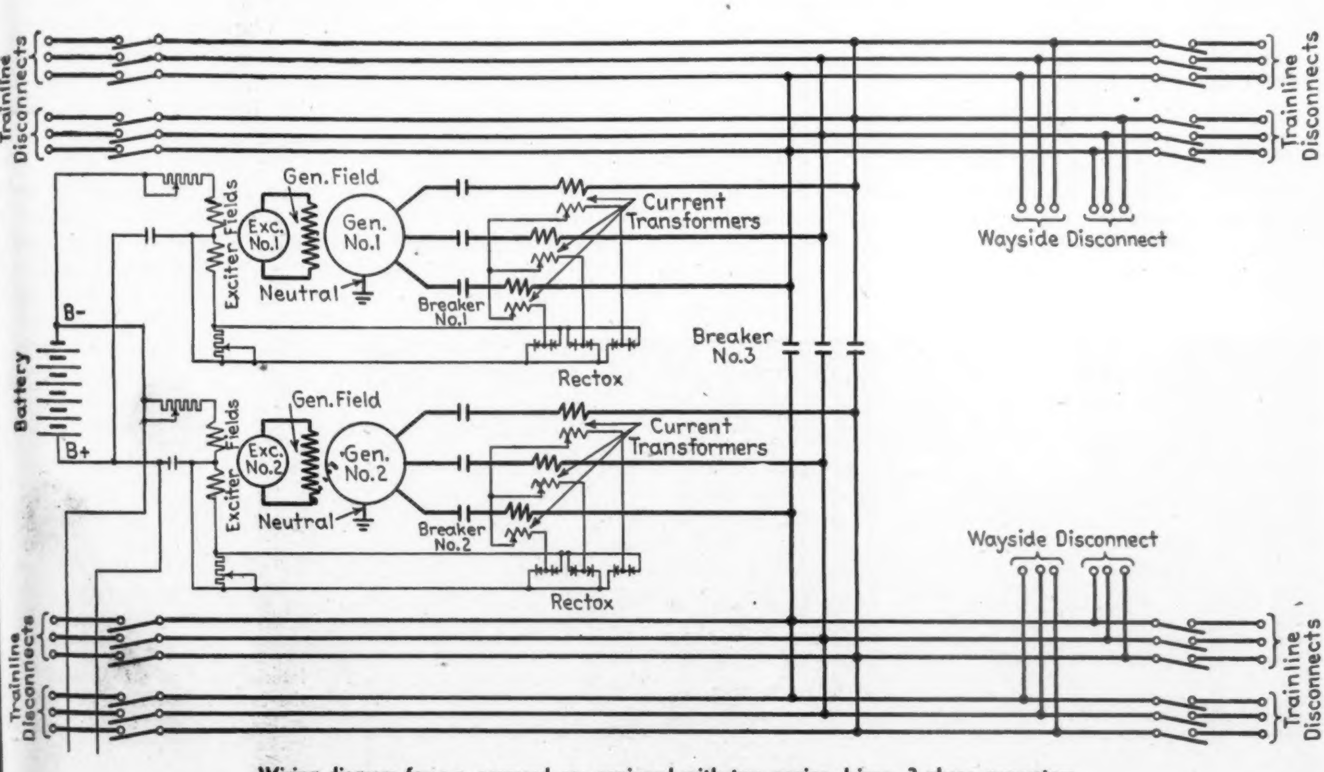
Switching equipment was provided to connect either one or both generators to either one or both of two three-phase train lines running in conduit the full length of each car in the train.

Most of the energy consumed on each car was to be taken directly from the 480-volt train line. Small dry-type transformers were provided to give 220-volts, 3-phase a.c. for some power utilization devices. A small rectifier on each car was proposed to charge a 176-amp.-hr., 16-cell emergency lighting battery.

The net weight of electrical and heating equipment on a car powered with the conventional d.c. axle generator system was 21,500 lb. Unit weight per car with head end power was 7,316 lb. The difference, over 7 tons per car, totalled 212,760 lb. on the 15 passenger-occupied cars. The net increase in train weight for head end power was less than 50 tons, and the head end power system imposed no drain on locomotive drawbar horsepower, and consumed no steam. The design eliminated many maintenance items entirely, and replaced commutator type motors with brushless and hermetically sealed induction motors.

The head end system ultimately was rejected in favor of axle generator drives, and large batteries, because operation of the new trains necessitated inclusion of foreign cars, not equipped with power train lines and a.c. utilization equipment.

(*Continued on page 321*)



Wiring diagram for a.c.-powered car equipped with two engine-driven, 3-phase generators

Power Car for Isolated Loads

New York Central develops a mobile power source for supplying exhibit trains, parked Pullmans, battery charging, etc., at locations where electrical energy is not available

THE New York Central has equipped a baggage car with a Diesel-electric power plant and other necessary appurtenances to fulfill the various demands for electric power that occur periodically on a railroad where there is no convenient local source. These demands include exhibit trains, parked Pullman cars used for hotel accommodations, battery charging, etc. The car has been used at a number of points with agricultural exhibit trains. It was also used to supply floodlights for taking motion pictures on a passenger train. In this case, the pictures were color movies used for railroad advertising and it was possible, by regulating generator voltage, to obtain the exact color temperature of the lighting required. The car may also be used for emergency lighting or for the operation of motors such as might be required for turntable operations.

The car is a 60-ft. steel automobile baggage car with end doors which facilitate the loading of portable rectifiers, when needed. The power plant in the car consists of a Ready Power unit consisting of a 60-hp. International Harvester Diesel engine, direct-connected to a 30-kw. 3-phase, 60-cycle, 220-volt, Y-connected generator. The voltage across terminals is 220, and the neutral is brought out so that 115 volts may be obtained between an outside terminal and the neutral. In this case, the excitation is reduced to lower the single-phase voltage from 127 to 115.

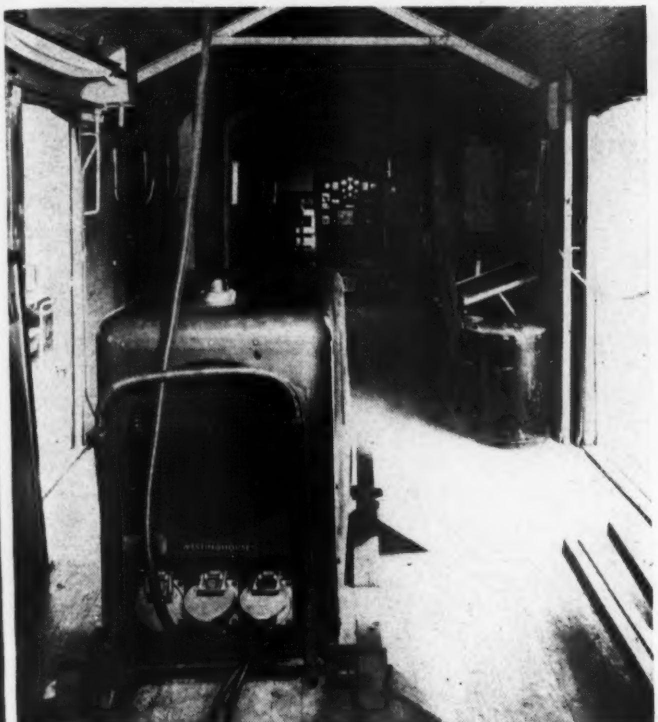
When d.c. power is required a portable rectifier is borrowed from the nearest yard and carried in the car. These rectifiers use 220-volt, 3-phase, a.c. to produce 40 to 80 volts d.c. for battery charging or for supplying d.c. standby requirements of cars not equipped with Genemotors or a.c.-d.c. compressor motors.

The power plant controls include a voltmeter and an ammeter, each reading for any phase, a field rheostat, field switch, line breaker, frequency meter, starter button, water temperature and oil pressure gauges and a time totalizer. The maintenance and lubrication schedule for the engine is based on total hours operated and the totalizer is used to determine overhaul and lubrication times. The car is usually operated by two electricians.

Power is carried from the car to other cars or points where it is needed by portable cables. From the generator terminals, connections are made to two standard, 3-phase standby receptacles on each end of the car. Inside the car is a fifth standby receptable with the neutral connected. This is used to provide 115 volts for lighting requirements. Connections to cars and other load points are made by portable cables. These consist of car-length (85-ft.) 2/0, single-conductor cables, equipped with Anderson Eitherend connectors. These cables are used for 3-phase, single-phase, d.c. battery charging or a.c. lighting. Since they are single conductor, they can be used for any application and are easy to handle and stow in the car. Being of car length, it is convenient to make connections with cars coupled end to end. Hooks on the side walls of the car are used for hanging stored cables.

Auxiliary equipment in the car includes lockers for

Interior of the car showing the control end of the power unit—At the left may be seen hooks for the portable cables and oil drum racks



One of the rectifiers which is carried when battery charging is necessary

clothes, brooms, tools, etc. There are also racks for fuel oil drums and containers for lubricating oil and anti-freeze liquid. A long steam hose with a tee connection is carried to allow connection with yard steam lines or a locomotive. The car has its own axle generator and batteries with overhead lighting units in the car. There are two sets of lights, one 30-volt d.c. and one 120-volt a.c. The engine has its own starting battery, which is charged from the generator exciter.

The car has been used with two agricultural exhibit trains which operated in two instances for one-month periods, first in New York State, with the agricultural department of the New York Central and Cornell University, and more recently with the agricultural department of Purdue University. The train was moved from town to town, staying from 3 to 5 hours in each location.

View under one end of the power car showing receptacles, types of terminals used on cables and method of supporting the portable cables when the car is in use

Power for Passenger Cars

(Continued from page 319)

Summary

On the basis of reliability and maintenance economy, self-powered, engine-driven car power systems eliminate numerous sources of failure and maintenance needs present on axle powered systems. The items eliminated include: generator drive, including belts or automatic clutch; generator speed switch; generator reversing switch; generator proper, including brush assembly; voltage regulator; large battery; lamp regulator; and battery drain at low speeds, or at standstill.

Failure of any one of these eight items will drain the battery, and result in a bad order car.

The equipment eliminated is replaced by internal combustion engines, and generators, involving fewer points of possible failure, and maintenance.

Alternating current-powered systems further reduce danger of failure, and maintenance expenses, by replacing commutators, shaft seals, and belts and pulleys, with brushless and hermetically sealed motors. Rotating conversion devices also are eliminated in a.c. systems.

Below is a weight comparison of four self-contained power systems designed and built during 1946:

Table I—Weight Comparison Passenger Coach Electrical and Heating Equipment—Four Types of Car Power Generation and Air Conditioning

Power Supply	Axle-Generator		Engine-Generator	
Air Conditioning	D. C.	St.-Jet	Gas.-Eng.	A. C.
Nominal Capacity	8 tons	6 tons	6 tons	8 tons
Battery—32 volt	1,000 amp.-hr.	1,000 amp.-hr.	400 amp.-hr.	176 amp.-hr.
Power supply, lb.	2,529	1,943	2,737	4,814
Battery, lb.	4,801	4,801	1,997	960
Cooling equipment, lb.	4,525	4,534	6,368	4,058
Heating equipment, lb.	910	910	910	418
Air cleaning lb.	56	56	56	56
Miscellaneous, lb.	740	740	740	163
Wire and cable, lb.	1,058	613	613	225
Conduit and fittings lb.	1,444	1,165	1,165	452
Total, lb.	16,063	14,762	14,586	11,498
Weight economy on a. c. car, lb.	4,565 (28.4percent)	3,264 (22.1percent)	3,088 (21.2 per cent)	

The engine powered systems inherently weight less than the axle generator systems. The higher voltage and smaller battery of the a.c. equipment results in a weight economy of nearly 30 per cent over the d.c. axle-generator powered equipment. Some weight can be saved on d.c. systems by going to 64- or 110-volt batteries.

Steam jet equipments on an 18-car train reduce car power drain on the locomotive by about 335 hp. Engine generator-powered cars save 757 drawbar hp. on the same train by eliminating axle generator drag. The power saved can be used to good advantage in maintaining materially-increased scheduled speeds, or in reducing the capacity of locomotives required to maintain existing speeds.

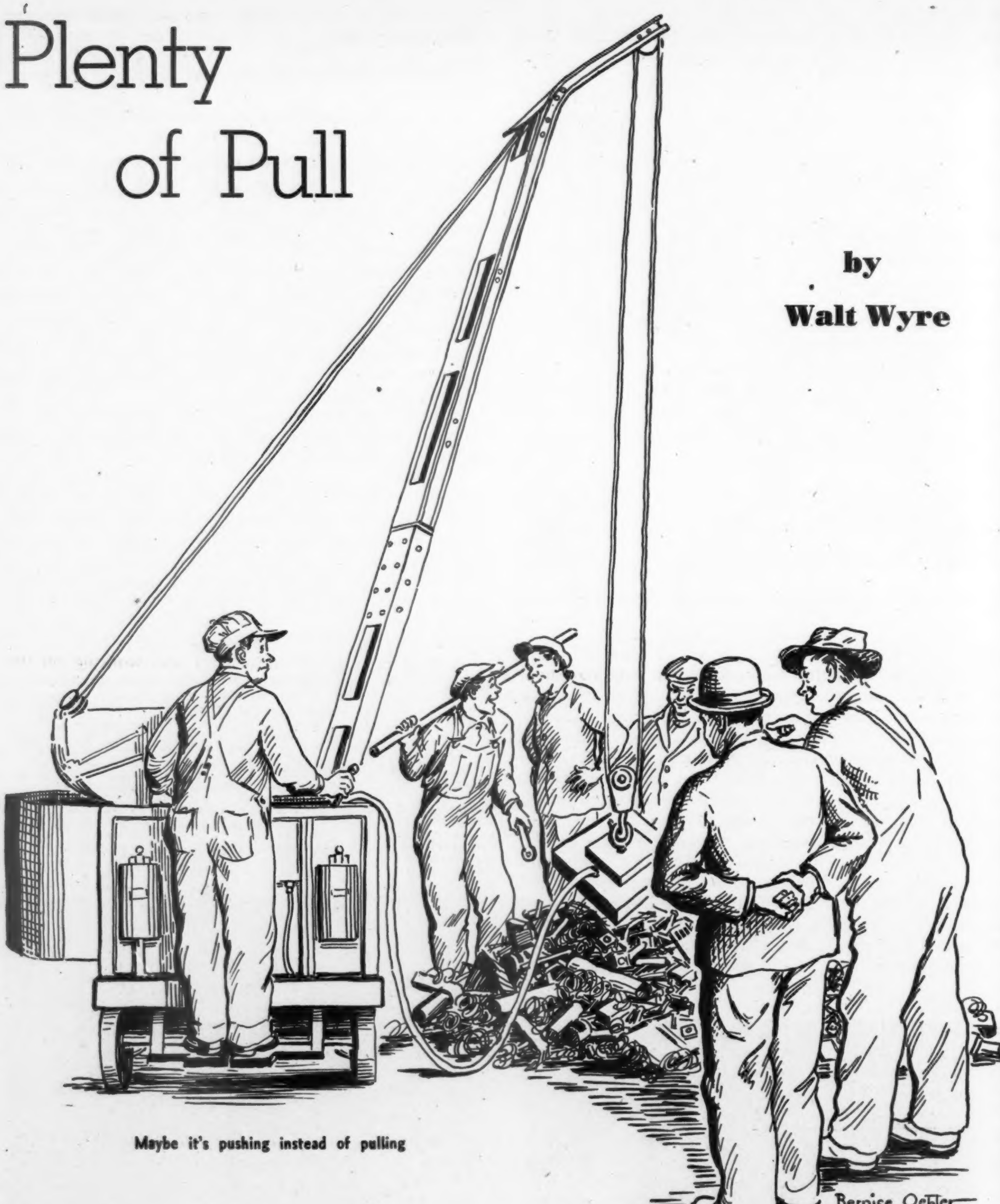
As electrical loads increase, the basic advantages of head end power, and of individually-powered a.c. cars become progressively greater. Head end power is available now for fixed consist trains, and individual a.c. plants have been proved for mixed trains.

The time to change to modern, realistic car power systems is now, and not after 12,000 to 15,000 cars have been built with outmoded car power systems.

Plenty of Pull

by

Walt Wyre



Maybe it's pushing instead of pulling

JIM EVANS was standing in the machine shop door watching a car being loaded with scrap. A large portion of the scrap consisted of metal shavings, old bolts, and other small bits of metal. When Evans first came to Pleasantville, more years back than he cåred to remember, there wasn't even a scrap dock. Usually a gondola stood on the spur and the scrap that accumulated each day was thrown into the car until it was loaded and hauled away. If there wasn't another empty car available at the time the scrap was piled on the ground beside the track until a car was spotted, then a gang of laborers threw the metal into the car by hand. They had no portable electric crane to handle that and many other jobs that cranes now handle at Plainville and other points on the S. P. & W.

The crane now in service was doing a good job, but it was still too slow to suit the foreman. Other jobs such

as putting up the rods on the 5076, moving a set of driving wheel tires, changing an air pump on the 5081 were waiting for the electric crane and Evans could, without scratching his head, think of others.

Metal containers were being used for carrying the smaller pieces of scrap; the containers were filled, then the crane lifted them to the car and dumped the scrap. Lots faster than loading by hand, but Evans begrudged the time required to fill the containers.

When Jim Evans starts thinking, his thoughts usually promote action. This time was no exception. The foreman took a chew of "horseshoe," pulled his derby hat down on his head and started towards the electric shop.

Ned Sparks, the electrician, was overhauling the spare turntable motor when Evans entered. "Turntable motor," Evans stated rather than asked to start the conversation.

"Yes, sir," Sparks replied. "It's the one we took off the turntable yesterday. Thought I'd better get it fixed up in case another motor went out."

"Much wrong with it?" Evans inquired.

"Oh, not a lot. The drive end bearing should be replaced and I was figuring on a new set of slip rings. These are burned badly and have already been turned down until they are too thin to take enough off to smooth them up."

"Good idea," Evans commented, then added apparently as an afterthought, "You know I've been thinking how handy it would be if we had a magnet for the portable crane."

"A magnet?" Sparks raised up from the motor and started wiping his hands with a piece of waste.

"You know—a magnet for lifting scrap iron and steel, especially for loading scrap."

"Figuring on ordering a magnet for the crane?" Sparks asked.

"No; don't think we'd have much chance of getting one if we did order it right now. Just wondered if maybe we couldn't build one."

"Well, I don't know." Sparks scratched his head thoughtfully. "Where would we get material for building it?"

"What'll you need?" Evans countered.

"Some wire for winding the coil—" Sparks hesitated a moment. "The frame should be mild steel, and a few other odds and ends," the electrician concluded.

"Doesn't sound like a lot," Evans said. "Why don't you start looking around to see what you can find. Let me know how you make out." The foreman readjusted his hat and left the electric shop.

The electrician stood leaning against the work bench thinking how in the heck he would build an electro-magnet that would do even a passable job of handling scrap. All scrambled up in the back of his head was a faint memory about ampere turns, maxwells, rels, magnetomotive force having something to do with electro-magnets, but he couldn't remember anything tangible to use as a base for figuring how to start building one for practical use. After getting dandruff under his fingernails and a sore place on his head where he had scratched, Sparks decided to quit worrying about the magnet and go back to work on the turntable motor. Maybe Evans would forget about the magnet soon as the scrap was loaded.

Sparks finished repairing the turntable motor by about three o'clock in the afternoon. Then, still thinking about the electro-magnet, he went to the storeroom to see what they had in the way of magnet wire. He found a large spool of 16 single cotton enameled wire, about six pounds of 18 enameled, and several odds and ends that couldn't be considered. He decided, if Evans pressed the point of making a magnet, to use the 16 wire. Disappointed because he had found wire that might do, Sparks returned to the electric shop. He found a water service man waiting for him.

"Something wrong with the treating plant," the water service man said.

"Is it the big pump motor or the chemical pump motor?" Sparks asked.

"The little chemical pump motor—it won't run."

"Okay," Sparks said, "I'll go up with you."

Sparks tested the fuses and found them good, then looked at the motor starter. The starter was apparently okay too and when he closed the contactors by hand the motor started and ran until the contactors were opened. "Must be an open circuit somewhere between here and the meter," Sparks said. "I'll take the cover off the box on the meter."

The treating plant was of the type whereby contact for operating the chemical pump motor is operated by the water meter, a cam actuated by the meter closing the contacts and holding them closed for a specified time each time a thousand gallons of water passes through the meter.

Sparks removed the cover from the top of the meter, exposing the contactors. He looked at the mechanism a moment, then said, "Wonder how in thunder the cam got off the shaft and out of the box."

"Is this it?" The water service man pulled a polished bit of metal from his pocket and held it up for Sparks to see.

"Yes, that's it. Where did you find it?"

"It must have fallen off when I was working on the meter," the water service man admitted. "I took the meter off to clean it up and that box on top of the meter was loose. After I put it back together I found this little gadget on the floor. It didn't seem to fit on the meter anyplace so I just stuck it in my pocket."

Sparks swore mildly, took the cam and replaced it on the shaft and the chemical pump motor started behaving normally.

"Ha-ha," the water service man laughed, "that's a good joke on me."

"Yes it is," Sparks remarked, "but I don't think it's very funny."

Next morning after Evans had lined up the work in the roundhouse and had everything going nicely, he hunted Sparks. He found the electrician in the machine shop working on the overhead crane. "What have you got up there?" Evans yelled up to Sparks.

"Not much," Sparks replied. "Some of the contactors on the hoist controller are burned a little, causing the controller to stick sometimes."

"When you get through come out to the office."

"Okay," Sparks yelled back, "I'll be out in about fifteen minutes."

The foreman nodded then went back towards the roundhouse.

"What I wanted to talk to you about was the magnet for the portable crane," Evans said when Sparks entered the office. "Have you done anything about it?"

"Not much," Sparks admitted.

"What about material?" Evans asked. "Did you find any?"

"Well, there's some No. 16 wire in the storeroom that I believe would do for the coil but I haven't figured anything out for the frame yet."

"If you'll let me know what you need, I'll see if I can find something for you," Evans said.

'Well,"—Sparks scratched his head to stimulate the

feeble idea he had regarding how the magnet frame should be built—"how big a magnet do you want to build?"

It was Evans' turn to scratch his head, but he managed to parry the question very nicely. "Oh, not too big a one, just a medium size magnet for loading small scrap. Wouldn't the kind of wire you wind it with have something to do with the size of the magnet?"

"Yes," Sparks admitted. "Do you think one about eighteen inches in diameter would be large enough?"

Evans pulled a small steel rule from his pocket and measured off eighteen inches on the desk. He sized up the distance a moment, then said, "Yes, one eighteen inches in diameter should do nicely if it had good lifting power. How much do you think one that size would lift?"

Again Sparks was stumped, but he didn't let the foreman know it. He racked his brain for an answer and for some reason he couldn't explain said, "Oh, around a hundred pounds, I'd say; maybe a little more or a little less, but a hundred pounds is a pretty good figure."

"Well, if you build one that will pick up a hundred pounds of steel shavings, that'll be fine," Evans said. "Now what'll we build the frame out of?'

"That's what's been bothering me," Sparks told the foreman. "It should be at least four inches thick mild steel. There would have to be a groove machined in the face of the steel for the coil to fit it," Sparks explained.

"How deep should the groove be and how wide?" Evans asked, "and how far from the outside edge? Here, take this scratch pad and make a sketch."

"Well, let me see. I'd say off hand the groove should be about two inches wide and a little deeper than it's wide and the area of the inside should be about the same as the area outside the groove." Sparks was sketching as he talked or talking as he sketched.

"Oh, yes, I get the idea," Evans said. "How will you hold the coil in place? Will there be anything to keep the coil from being damaged?"

"Yes, sir," Sparks said, "there'll be a plate over the face of the magnet."

"Looks like it should be okay," Evans said. "Now if we can find something to make it out of, I'll look around and you do the same. If you find anything, let me know."

It's surprising how few pieces of mild steel four or more inches thick and at least eighteen inches in diameter are to be found lying around railroad shops, but if there were any around the shops at Plainville neither Evans nor Sparks could find it. There might have been something that could have been used for the magnet frame before the war caused a cleanup of all scrap, but if there were it had long since been shipped away.

After Evans had made a thorough search for a piece of steel and found none, the idea struck him of building one up. He went to the electric shop and mentioned the idea to Sparks. "Why can't we build up several layers of sheet steel?" Evans suggested to Sparks. "We could turn them out on a lathe to the right size, then drill holes in the pieces and rivet them together."

"Afraid that wouldn't work very well," Sparks told Evans. "You see, the space between the plates would cause some resistance to the flow of magnetism and reduce the strength of the magnet."

"Even if the plates were riveted solidly together?"

"Yes, sir. I don't believe they could be riveted solid enough." Sparks shook his head.

"Well, it was an idea, anyway," Evans said. "I hoped it would work since it seems like we are not going to find a solid piece." The foreman turned and started to leave the shop.

"It might work if we could figure out some way to stand the pieces on edge," Sparks said thoughtfully.

Evans came back and sat down on the workbench. Sparks took a piece of soapstone from his pocket and began sketching on the cement floor. He made half a dozen drawings and was satisfied with none of them.

"Say, why couldn't we make the magnet square instead of round?" Evans slid from the workbench and took the piece of soapstone while Sparks watched.

"Well, I don't know," Sparks said doubtfully. "All the magnets I ever saw, that is for handling scrap, were round. I guess there's not any law against us building a square magnet if we want to."

"Why don't we try it?" Evans asked.

"Suits me," Sparks said, "but we've got to figure out some way to make a good solid magnetic connection between the pole pieces and the back plate."

"What do you mean, pole pieces?" Evans wanted to know.

"Those are the pieces inside and outside the magnet coil," Sparks told him.

After considerable discussion it was finally decided to build a square frame for the magnet. The outside pole piece was to be a square frame eighteen inches on the outside, two inches thick, and four inches deep. The center pole piece was built up ten inches square. A two-inch slot for the coil took up the rest of the space. A piece of sheet steel seven-eighths of an inch thick was to form the back. After considerable thought, Sparks decided the back piece should be slotted and the pole pieces mortised and acetylene welded in from the top and a fillet run on both sides of the pole pieces on the under side to reduce reluctance. An additional piece of steel eight inches square and one inch thick was welded on top of the center pole piece. This piece was drilled and an eye bolt set in for hanging the magnet on the crane hook. After being assembled and welded, the entire magnet frame was annealed.

While the other mechanics were working on the frame, Sparks was winding the coil. He made a form so the coil would fit loosely in the slot and allow room for insulation. After some figuring, Sparks decided that perhaps the No. 16 wire wouldn't carry sufficient current to give the required ampere turns and as he had plenty of slot room he decided to wind the coil with two wires in parallel. That of course would halve the resistance and double the carrying capacity. One thousand turns seemed like a good round number of turns. Several different men came by and talked to Sparks while he was winding the coil and he lost track of the exact number of turns, but he figured he had somewhere close to a thousand turns when he quit. The coil was insulated with two half lapped layers of cotton tape and dipped in air-drying insulating varnish. Two flexible leads of No. 12 stranded wire was soldered to the coil ends. Holes were drilled in the top plate of the magnet frame for the leads to pass through and the magnet was ready to assemble.

The foreman came into the electrical shop when Sparks was fixing to hang the coil up to dry. "That's a pretty good-looking coil," Evans said. "Now if it'll just work as good as it looks. Counting time and material, we've spent enough on this to buy two or three magnets—chromium plated! Do you think a piece of quarter-inch plate will be heavy enough for the face?"

"Should be," Sparks replied without considering the question.

The machinist did a neat job of fitting the plate to the face of the magnet frame. He drilled and tapped holes every two inches in the outside pole piece one inch from the edge for quarter-inch bolts. Another row of holes

were drilled and tapped one inch from the outside edge of the center pole piece. He used flathead stove bolts and countersunk the heads in the plate.

Sparks hung the coil in a nice warm place in the boiler room and the varnish was well dried next morning when he came to work. He was anxious to get the magnet finished and see how it was going to work, but something had gone wrong with the drop-pit the night before and that had to be fixed first.

Trial showed that the motor would operate to lower the drop-pit table but would not raise it. That limited the probable causes of the trouble. Sparks soon located a limit switch stuck open as the cause of the trouble and was ready to go back to his magnet.

The magnet frame was still in the machine shop where the machinist had been fitting the face plate. Sparks took the coil and some sheets of fibre to use wedging the coil in place in the slot.

It didn't take long to fit the coil in place. The biggest job was fastening the plate with all the stove bolts that held it. The leads from the coil were brought out and left loose. After the test, if successful, Sparks figured on using a detachable plug for connecting and disconnecting the wires. Right then, however, he planned to make a temporary connection by twisting the ends together and taping them.

The portable crane was being used for hauling driving-boxes to the machine shop at the moment, but Evans had the crane operator quit and come try the magnet.

The crane operator ran the crane into the machine shop and picked up the magnet with the hook. Sparks used some No. 12 headlight to connect the magnet. He used a 30-amp. double pole fused switch to make and break the circuit, mounting the switch temporarily by tying it on the top of the controllers where it would be handy for the operator.

"All set," Sparks said when he had finished connecting the switch. "Shall we try it here or somewhere else?" What the electrician wanted to do was take the crane some place away from the crowd that had gathered to watch the test.

"Let's go out to the scrap dock and see what it'll do," Evans suggested.

The operator ran the crane out to the scrap dock. He lowered the magnet into a pile of steel shavings and closed the switch. Nothing happened.

Sparks opened and closed the switch to see if current was flowing through the magnet coil. A slight arc when he opened the switch showed that current was flowing.

"Maybe the wires are hooked up wrong," a machinist suggested, "and it's pushing instead of pulling."

If Sparks was disappointed because the magnet wouldn't work, Evans was more so. "Maybe we should have made it round like you wanted to," Evans said to Sparks, then turned and went to the roundhouse.

"What'll I do with it?" the crane operator asked, meaning the magnet.

"Take it back to the machine shop, I guess," Sparks said dolefully.

The crane operator started the hoist and lifted the magnet. There wasn't even a small iron shaving sticking to it. Sparks was watching anxiously. Then suddenly he realized why the magnet wouldn't work.

"I know what the trouble is," Sparks said. "Take it to the electric shop."

"Okay," the crane operator said, "but it's not far to the hot well. I could drop it in there easy enough."

When the magnet was in the electric shop, Sparks set to work removing the screws that held the iron plate on the face of the magnet. After working about two hours, he was ready to try the magnet again. He found the crane operator and persuaded him to run the crane to the electric shop and pick up the magnet. Sparks again connected the wires and as before they went to the scrap dock.

The magnet was lowered to the pile of iron cuttings as before. When the switch was closed, the bits of metal seemed to come alive and rush to the magnet like a bunch of women going to a department store that is selling nylon hose.

"Lift it up!" Sparks said exultantly.

When the magnet was lifted, a large mass of the iron shavings clung to the magnet and to each other. When the switch was opened, the shavings fell off.

"Wait until I find the foreman," Sparks said and started towards the roundhouse.

"That's fine," the foreman said when the lifting powers of the magnet was again demonstrated. "Why it's picking up at least two hundred pounds of scrap, maybe more! That's twice what you figured it would do. What was the matter with it when we tried it the first time?"

"Why—er—," Sparks stammered, "the magnetic lines of force was kinda short circuited," he explained lamely.

"Well, it makes no difference, it works okay now," Evans said. "When you have time fix the switch and wires permanently."

Evans left without noticing that the steel plate had been removed from the face of the magnet and a brass plate that wouldn't "short circuit the magnetic lines of force" substituted.

* * *

F. W. Beichley, Westinghouse district engineer, making final adjustments on Westinghouse type MR radio transmitting and receiving equipment on the front end of one of Southern Pacific's cab-ahead freight locomotives used in recent communications experiments in the Cascade Mountains of southern Oregon. The photo shows the compactness and ease of accessibility of the shock-mounted slide-in type mobile unit

NEWS

Mechanical and Purchases and Stores Divisions Programs

The Mechanical Division and the Purchases and Stores Divisions will meet at the Convention Hall, Atlantic City, N. J., the former Monday, June 23, through Friday, June 27, and the latter Monday, June 23, through Wednesday, June 25. The Divisions will convene, in joint session with the Railway Supply Manufacturers' Association, at 10 a. m., Daylight Saving Time, June 23. Following the call to order by Norman C. Naylor, president of the supply association, and the invocation, there will be addresses by the Hon. Joseph Altman, mayor of Atlantic City; William T. Faricy, president, A. A. R., and J. H. Aydelott, vice-president, Operations and Maintenance Department, A. A. R. The members of the Divisions will then take up the following programs on successive mornings, beginning at 9:30 a. m., the Mechanical Division in Room B, of the Convention Hall and the P. & S. Division in Room A. Afternoons and Saturday, June 28, will be set aside for the inspection of exhibits.

Mechanical Division

MONDAY, JUNE 23

Address by J. M. Nicholson (chairman), assistant to vice-president, Atchison, Topeka & Santa Fe
Action on Minutes of 1946 meeting
Appointment of committees on subjects, resolutions, etc.
Unfinished business
New business
Report of General Committee
Report of Nominating Committee

TUESDAY, JUNE 24

Paper on Gas Turbines by John I. Yellott, director of research, Bituminous Coal Research, Inc.
Discussion of reports on:
Locomotive Construction
Further Development of the Steam Locomotive

WEDNESDAY, JUNE 25

Address by the Hon. W. J. Patterson, member, Interstate Commerce Commission
Paper on Diesel Locomotive Operation and Maintenance by J. P. Morris, general mechanical assistant, Atchison, Topeka & Santa Fe
Discussion of reports on:
Specifications for Materials
Safety Appliances
Brakes and Brake Equipment
Wheels
Lubrication of Cars and Locomotives
Hot-Box Alarm Devices

THURSDAY, JUNE 26

Paper on Stress Analysis of Passenger Cars, by K. F. Nystrom, chief mechanical officer, Chicago, Milwaukee, St. Paul & Pacific
Discussion of reports on:
Arbitration
Prices for Labor and Materials
Tank Cars
Loading Rules
Lumber Loading Rules
Couplers and Draft Gears
Journal Bearing Development

FRIDAY, JUNE 27

Paper on Future Car Construction, by L. K. Sillcox, first vice-president, New York Air Brake Company
Discussion of reports on:
Car Construction
Geared Hand Brakes
Election of officers and members of General Committee
Report of Committee on Resolutions

Purchases and Stores Division

MONDAY, JUNE 23

Meeting called to order by C. H. Murrin (chairman)
Communications
Appointment of committees (resolutions and memorials)
Action on minutes of 1946 annual meeting
Report of General Committee
Address by Chairman Murrin, general storekeeper, Louisville & Nashville
Presentation and discussion of reports on:
Subject 1—Purchases & Stores Department Manual — Recommended Rules and Practices
Subject 2—Standard Material Classification
Subject 3—Scrap, Handling and Preparation—Classification and Sale
Subject 3A—General Reclamation
Subject 4—Material Stock Report — Inventory and Pricing Methods and Practices
Subject 8—Shop Manufacturing

TUESDAY, JUNE 24

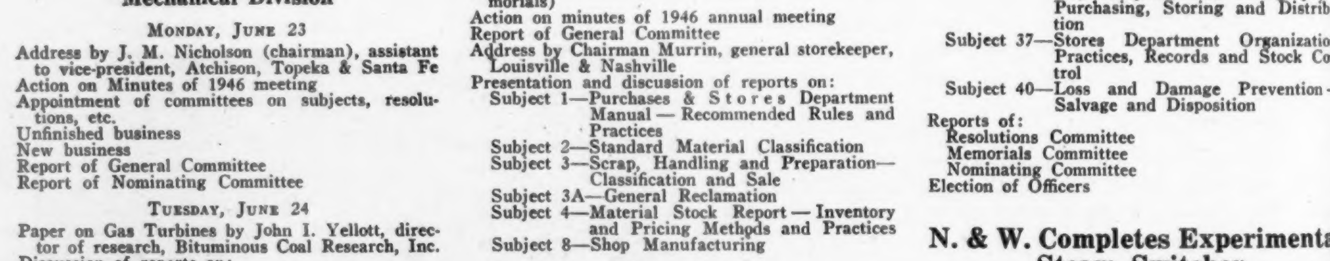
Address on Benefits to Be Derived by Active Participation in the Division and the Importance of the Use of Fundamentals Recommended by the Division, by General C. D. Young, vice-president, Pennsylvania
Presentation and discussion of reports on:
Subject 5—Forest Products
Subject 12—Purchasing Department—Organization and Procedure
Subject 13—Stationery and Printing
Subject 14—Fire Prevention—Safety Practices —Purchasing & Stores Department
Annual Essay Contest Committee:
Selected Best Papers:
Public Relations—A Job for Us All, by Harry C. Miller, 'secretary to vice-president, purchases and stores, Illinois Central
How Far Can the Stores Department Go in Establishing Minimum Stocks? by W. P. Brown, division storekeeper, C. R. I. & P.
Presentation and discussion of reports on:
Subject 42—Diesel Locomotive Parts—Purchasing and Storekeeping
Subject 15—Storage and Material-Handling Facilities
Subject 19—Capacity Loading and Prompt Handling of Cars of Company Materials and Reduction of Non-Revenue Ton Miles
Address by W. C. Kendall, chairman, Car Service Division, A.A.R.
Subject 21—Purchasing, Storage and Distribution of Equipment and Supplies Used in Dining Cars, Hotels and Commissaries

WEDNESDAY, JUNE 25

Address on Public Relations, by C. E. Smith, vice-president, New York, New Haven & Hartford
Presentation and discussion of reports on:
Subject 9—Fuel-Coal, Fuel Oil and Diesel Fuel Oil
Subject 16—Simplification and Standardization of Stores Stock
Subject 23—Material Conservation
Subject 29—Exchange of Materials
Subject 34—Maintenance of Way and Construction Materials (Including Signal, Telephone and Telegraph)—Purchasing, Storing and Distribution
Subject 37—Stores Department Organization, Practices, Records and Stock Control
Subject 40—Loss and Damage Prevention—Salvage and Disposition
Reports of:
Resolutions Committee
Memorials Committee
Nominating Committee
Election of Officers

N. & W. Completes Experimental Steam Switcher

The Norfolk & Western has completed at its Roanoke, Va., shops an experimental steam switching locomotive which was de-



Experimental switcher now undergoing tests on the Norfolk & Western

veloped to determine the possibilities of modernizing switchers already in service. After preliminary tests at the Shaffers Crossing locomotive terminal in Roanoke, the engine is to go into actual service at the passenger station and other places on the Roanoke terminal and probably at other points on the road.

To make the engine available for around-the-clock service, the tender's capacity was increased and mechanical lubrication was applied, making unnecessary any attention to the machinery or the taking on of fuel for continuous service of 24 hours. Water level controls and stoker controls, with which the engine can be left unattended for some time, were applied. In order to secure fast steaming, more complete combustion and an appreciable reduction in the emission of smoke, thereby obtaining greater boiler efficiency, the locomotive was given increased heating surface and equipped with a turbine-driven fan for induced draft. The fan, stoker, ashpan dampers and the standby water feed pump are all tied in together and governed by automatic control.

International Railway Congress

THE 1947 plenary session of the International Railway Congress Association will be held June 23 to 28, inclusive, in Lucerne, Switzerland. The last previous session was in Paris in 1937. Topics scheduled for discussion this year include crossties; reduction in the weight of rolling stock; frequency and economy of passenger service under different conditions; and company-built housing for employees and officers.

High Steam Locomotive Utilization Reported to B. C. R.

HIGH utilization records for coal-fired steam locomotives were reported to operating and mechanical officers of many railroads of the United States and Canada who met as guests of the motive-power committee of Bituminous Coal Research, Inc., at Battelle Memorial Institute, Columbus, Ohio, on April 29.

The report referred to six coal-fired Class S 4-8-4 type locomotives of the New York Central, of which individual engines exceeded 28,000 miles per month during the six-months' period October 1, 1946, through March 31, 1947, and in which all six operated 786,818 miles for an average of almost 22,000 miles per month. The locomotives were assigned to passenger trains running between Harmon, N. Y., and Chicago, a distance of 926 miles, and, according to E. C. Payne, chairman of B. C. R.'s steam-locomotive performance subcommittee, burned mechanically cleaned egg-size coals from western Pennsylvania, Ohio, and southern Illinois. They were refueled twice en route between the Harmon and Chicago terminals.

Announcement of the development of a device known as an "undergrate air distributor" for railroad steam locomotives was also made at this meeting. The device is reported to increase the efficiency of burning coal in the steam locomotive by improving the distribution of undergrate air for combustion. With uniform air flow to the fuel bed, excessive losses of unburned coal out of the stack are avoided and the value of bituminous coal as a locomotive fuel is increased. Road tests, it was reported, indicate fuel savings of 7 to 15 per cent, depending on the speed of the locomotive. Another important advantage claimed is a reduction in clinkering, which lowers maintenance cost and increases the availability of the locomotive.

Perfecting the device in cooperation with the inventor — Vaughn Mansfield, chief engineer of the Southern Coal Company, Memphis, Tenn.—was a major engineering project of Bituminous Coal Research.

The meeting was held to analyze current progress of the locomotive research projects being directed by B. C. R. and to determine the scope of future activity.

Moran Becomes Assistant Mechanical Engineer, A. A. R.

GEORGE U. MORAN, formerly research investigator of the subcommittee on engineering and mechanical research of the Association of American Railroads, at Chi-

Orders and Inquiries for New Equipment Placed Since the Closing of the May Issue

LOCOMOTIVE ORDERS

Road	No. of locos.	Type of loco.	Builder
Bangor Aroostook	12	1,500-hp. Diesel-elec. frt.	Electro-Motive
Chicago, Rock Island & Pacific	2[1]	1,500-hp. Diesel-elec. pass.	Fairbanks-Morse
Minneapolis, St. Paul & Sault Ste Marie	8	1,500-hp. Diesel-elec road switchers	Baldwin Loco. Works
New York Central	2[2]	2,000-hp. Diesel-elec. frt.	Fairbanks-Morse
	12[2]	2,000-hp. Diesel-elec. pass.	Electro-Motive
	18[2]	1,500-hp. Diesel-elec. frt.	Electro-Motive
	6[2]	1,500-hp. Diesel-elec. frt.	Baldwin Loco. Wks.
	2[2]	1,500-hp. Diesel-elec. road switchers	American Loco. Co.
	17[2]	1,500-hp. Diesel-elec. frt.	American Loco. Co.
	9[2]	1,000-hp. Diesel-elec. road switchers	American Loco. Co.
	2[2]	1,500-hp. Diesel-elec. road switchers	American Loco. Co.
	2[2]	2,000-hp. Diesel-elec. pass.	American Loco. Co.

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Atchison, Topeka & Santa Fe	225	70-ton hopper	Pullman-Standard
Belt Ry. of Chicago	20	30-ton caboose	International Ry. Car & Equip. Co.
Chesapeake & Ohio	3,000[3]	70-ton hopper	American Car & Fdry.
Chicago & North Western	1,400[4]	50-ton box	American Car & Fdry.
Consolidated Chemical Industries	25	100-ton tank	General-American
Denver & Rio Grande Western	10	Caboose	Company Shops
Detroit Chemical Works	2	50-ton tank	General-American
Fruit Growers Express	1,100[5]	40-ton refrig.	Company Shops
General American Transportation Corp.	10	40-ton tank	Company Shops
	62	Various capacity tanks	Company Shops
Detroit & Mackinac	25	50-ton hopper	General American
	10	70-ton covered hopper	General American
Kansas City Southern	400	50-ton box	Pullman-Standard
Monsanto Chemical Co.	9	50-ton tank	General-American
Northern Pacific	1,000	50-ton box	Company Shops
Pittsburgh & Shawmut	200	50-ton hopper	Pressed Steel Car
Southern	150	70-ton covered hopper	Pullman-Standard
Stauffer Chemical Co.	3	50-ton tank	General-American
	2	70-ton tank	General-American
Virginian	1,000	55-ton hopper	Company Shops
Wabash	600	50-ton box	Company Shops

FREIGHT-CAR INQUIRIES

Road	No. of Cars	Type of car	Builder
Chicago, Milwaukee, St. Paul & Pacific	1,000	50-ton hopper	
	250	70-ton hopper	
	250	50-ton gondola	
New Jersey, Indiana & Illinois	100	50-ton automobile	
Union Pacific	400	70-ton covered hopper	

PASSENGER CAR ORDERS

Road	No. of cars	Type of car	Builder
Chicago, Rock Island & Pacific	2 6-car trains[6]	Articulated	Pullman-Standard

[1] To cost $137,000 each.

[2] Delivery of this equipment expected this year. The passenger and freight units will be utilized in variou combinations to provide 1,500 to 6,000 hp. The road-switching units will be used in way freight train service. Eight of the passenger units and 28 of the freight units will be of the A type. Of the remaining units, 8 for passenger service and 13 for freight service are of the B type, which must be operated in combinations.

[3] The cars, which will be of welded construction and will cost approximately $10,500,000, will be built at Huntington, W. Va., and are to be equipped with friction bearings.

[4] Four hundred for the Chicago, St. Paul, Minneapolis & Omaha.

[5] Order contemplated.

[6] Each train of three articulated units will cost $200,000. For suburban service.

NOTES:—*Kansas City Southern.*—The report in the May issue that the Kansas City Southern had ordered four 2,000-hp. Diesel-electric A units from Fairbanks, Morse & Co. was incorrect inasmuch as the K.C.S. had actually received delivery of two such units and had ordered two more.

Great Northern.—Spending of approximately $9,000,000 for new motive power and freight equipment has been authorized by the Great Northern. The equipment is to include nine 4,500-hp. Diesel electric locomotives for freight and passenger service, 500 box cars to be built in the road's shops, and 400 refrigerator cars to be constructed for the Western Fruit Express, a subsidiary of the G. N. The Diesels are expected to be delivered late this year.

Missouri Pacific.—The Missouri Pacific has been authorized to purchase 49 Diesel-electric locomotives, costing $15,809,000. Thirty-nine of the new units—consisting of four 2,000-hp. passenger locomotives and of 1,000-hp. switchers and freight units of 1,500 hp., 3,000 hp. and 4,500 hp.—will be placed in service on the line between Osawatomie, Kan., and Pueblo, Colo. The M. P.'s Texas lines will receive 10 freight locomotives, of which six will be two-units of 3,000 hp. and four will be three-units of 4,500 hp. P. J. Neff, president and chief executive Officer of the road, says that "as fast as the new equipment is delivered, estimated to be from four to twelve months hence, old steam locomotives that would have required extensive repairs will be retired."

St. Louis-San Francisco.—The board of directors of the St. Louis-San Francisco has authorized the purchase of 19 Diesel-electric road and switching locomotives at an estimated cost of $5,719,000. The purchase will comprise 46 units, i.e., nine four-unit 6,000-hp. freight locomotives and 10 1,000-hp. switch engines.

cago, has been appointed assistant mechanical engineer, Mechanical Division, Department of Operations and Maintenance, with headquarters at Chicago. Mr. Moran was born at West Lafayette, Ind., on January 10, 1898, and is a graduate of Amherst College (1920) with an A. B. degree and of Purdue University (1922) with a B. S. degree in mechanical engineering. From 1922 to 1930 he was engaged in power-plant operation for the Detroit Edison Company, at Detroit, Mich. In 1930 he was appointed research engineer; in 1942 became chief of the security branch of the Detroit ordnance district, and in July, 1944 research investigator of the subcommittee on engineering and mechanical research.

Supply Trade Notes

UNION ASBESTOS & RUBBER CO.—*R. E. Cryor,* general manager of the asbestos division, Union Asbestos & Rubber Co., with headquarters at Cicero, Ill., has been elected a vice-president and director of the company.

◆

OKONITE COMPANY.—*Edward A. Damrau,* formerly in charge of the Pittsburgh, Pa., office of the Okonite Company, has been appointed manager of the new branch office in the Chamber of Commerce building, Charleston, W. Va. Mr. Damrau will handle all electrical wire and cable sales in West Virginia and adjacent parts of Kentucky and Virginia, for both Okonite and its Hazard insulated wire works division.

◆

MONARCH MACHINE TOOL COMPANY.—*Wendell E. Whipp,* president of the Monarch Machine Tool Company since 1931, has been elected chairman of the board, to succeed the late *F. P. Thedieck. Jerome A. Raterman,* formerly executive vice-president, has been elected president.

◆

BORG-WARNER CORPORATION.—The Borg-Warner Corporation has acquired, under the terms of a sales agreement, the Franklin, Pa., steel works of the *Chicago Railway Equipment Company.* Borg-Warner's Pesco products division has begun line production of hydraulic pumps for industrial use.

CARBOLOY COMPANY. — The Carboloy Company, Detroit, Mich., has appointed *Paul H. Holton,* formerly sales engineer in the Philadelphia, Pa., area, as manager of its Atlantic district office at Newark, N. J., to succeed *T. D. MacLafferty,* resigned. *Paul Schick,* formerly in the Detroit plant, succeeds Mr. Holton at the Philadelphia branch.

◆

HUNT-SPILLER MANUFACTURING CORPORATION.—*Raymond C. Schleihs* has been appointed representative in the northwest territory for the Hunt-Spiller Manufacturing Corporation of Boston, Mass.

◆

TEXAS COMPANY.—*J. M. P. McCraven,* assistant manager of the Texas Company, has transferred his headquarters from New York to 1204 McCormick building, Chicago 4.

◆

CHAMPION RIVET COMPANY.—*Thomas J. Lawless,* formerly sales manager of the Champion Rivet Company, has been elected vice-president in charge of sales.

◆

NATIONAL MALLEABLE & STEEL CASTINGS CO.—The *National Malleable & Steel Castings Co.* has licensed Industrial Steels, Ltd., of Sidney, Australia, to manufacture its patented car couplers, freight car trucks, draft gears and other railroad specialties in that country.

* * *

Photo courtesy of W. A. Lucas

A pair of "Camelbacks" on the Reading at Newtown, Pa.

John R. Kingman, sales agent at the St. Louis, Mo., office of the *National Company,* has been transferred to the Richmond, Va., office, to work on sales development in the southeastern territory served by that office.

◆

VAPOR CAR HEATING COMPANY.—*John T. Elwood,* service representative of the Vapor Car Heating Company, at Chicago, has been appointed district engineer of the company's office at St. Louis, Mo. *C. E. Miller,* service representative, has been appointed district engineer at Philadelphia, Pa. *Thomas J. Mahoney,* district engineer at St. Louis, Mo., has been appointed acting manager, with headquarters at St. Louis, replacing *E. J. Bryant,* who has retired. A new office has been opened at Cleveland, Ohio, under the management of *H. E. Nichols,* formerly sales representative in the Chicago office.

◆

GENERAL MOTORS CORPORATION.—*Frederick G. Hughes,* vice-president of the General Motors Corporation and general manager of its New Departure division at Bristol, Conn., has retired after 36 years' association with the division. *Milton L. Gearing,* formerly plant manager for the division at Meriden, Conn., has been appointed general manager to succeed Mr. Hughes.

◆

GENERAL ELECTRIC COMPANY.—*Horace A. Davis* has been appointed New York district manager of the transportation division of the General Electric Company, to succeed *R. M. Darrin,* who has been appointed assistant New York district manager of the Central Station division.

Horace A. Davis joined General Electric in August, 1912, as a student engineer. He left the company in April, 1916, but returned in 1920 and for three years was an instructor on various assignments. He then transferred to the Erie, Pa., works, serving successively in the air brake engineering and the transportation engineering divisions. In 1939 he was appointed sales engineer for the transportation division, New York district.

R. M. Darrin joined General Electric in June, 1919, as a commercial engineer in the Central Station Division at the Pittsfield works. In 1928 he was placed in charge of holding companies and Central Station sales at the Buffalo, N. Y., office. In July, 1940 he was appointed manager of the Syracuse, N. Y., office, and in April, 1945, New York district manager of the transportation division.


"I'll be seeing you
AT SPACE K-1 and K-2
AT THE
A. A. R.
CONVENTION"

O. C. Duryea Corporation.—*V. R. Weiss,* whose election as president of the O. C. Duryea Corporation, was reported in the May issue, was born on April 19, 1899, at Baltimore, Md., and was educated in the public schools of Boston, Mass., and Chicago. He began his career as a clerk in the stores department of the General American Transportation Corporation at

V. R. Weiss

East Chicago, Ind., on January 5, 1920. In 1923 he became foreman of the firm's lumber yard at East Chicago, and in November, 1926, general storekeeper. He was appointed purchasing agent in August, 1936, and in 1941 was transferred to Chicago. Mr. Weiss was appointed general purchasing agent for General American and all its subsidiaries in 1944, the position he held at the time of his election as president of the O. C. Duryea Corporation.

◆

American Locomotive Company. — *Stephen G. Harwood,* formerly district sales manager for the American Locomotive Company in San Francisco, Calif., has been appointed New York district sales manager, to succeed *L. S. Peabody,* who

Stephen G. Harwood

has been appointed assistant to vice-president Norman C. Naylor.

Stephen G. Harwood is a graduate of Dartmouth College (1932). In the same year he became employed in the sales department of the Goodyear Tire & Rubber Co. In 1936 he became associated with American Locomotive as a sales representative in Chicago and later was appointed district sales manager in San Francisco.

◆

Roxalin Flexible Finishes, Inc.; Interchemical Corporation.—The operations of Roxalin Flexible Finishes, Inc., and the Interchemical Corporation have been combined with the finishes division of Interchemical. The personnel of both firms remain the same.

◆

William Sellers & Co.; Consolidated Machine Tool Company.—William Sellers & Co. has announced its intentions of removing its Philadelphia, Pa., office to Rochester, N. Y., and of merging with the Consolidated Machine Tool Company.

◆

Bird-Archer Company.—The *John H. Carter Company,* New Orleans, La., has been appointed representative of the Bird-Archer Company in Louisiana, southern Arkansas, eastern Texas and southern Mississippi.

◆

Eaton Manufacturing Company. — *E. D. Cowlin,* in 1930, was appointed general sales manager of the Reliance division, at Massillon, Ohio, set up by Eaton

E. D. Cowlin

after its merger with the Reliance organization, of which he had become manager of the New York sales office in 1924. Upon the retirement of W. H. Crawford in 1945, Mr. Cowlin was appointed resident manager of the Reliance division.

H. J. McGinn joined Reliance in 1913 as manager of the Chicago sales office, and later became general sales manager at Massillon. In 1931 he was elected a vice-president of Eaton, and in 1932 a director. In 1941 he was appointed general manager of the Reliance division.

Miscellaneous Publications

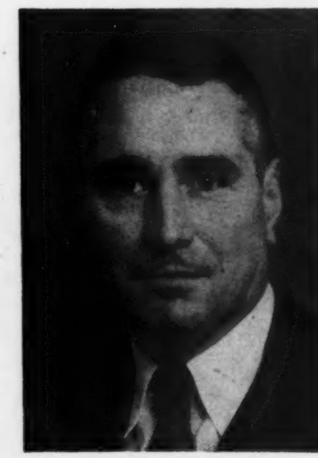
Bullard Company, Bridgeport 2, Conn. —Twelve-page booklet illustrates and describes, with specifications, the Bullard 30-in. by 20-in. Man-Au-Trol spacer, a semi-automatic movable work table, for installation on 4-, 5-, or 6-ft. radial drills having accurate drill spindles and rigid arm clamps. A second booklet discusses the development and use of the spacer in the Bullard plant and contains facsimile letters from customer users.

Nelson Stud Welding Corporation.—*Fred Meyer* has been appointed chief engineer of the railroad industry division of the Nelson Stud Welding Corporation, Lorain, Ohio. Mr. Meyer, a graduate of Armour Institute of Technology, was previously a member of the sales engineering staff of the Owens-Corning Fiberglas Corporation.

◆

American Welding & Manufacturing Co.—*Henry H. Knapp* has been appointed a sales representative of the railway equipment division of the American Welding & Manufacturing Co., Warren, Ohio.

Henry H. Knapp began his career in 1927 in the equipment engineering division



Henry H. Knapp

of the New York Central. In 1941 he was appointed special representative for the prevention of damage to car lading for the entire New York Central System. In 1945 he became service engineer of the American Welding Company.

◆

Johnston & Jennings Co.—*George L. Fox* has been appointed sales manager of the Rusta Restor division of the Johnston & Jennings Co., Cleveland, Ohio, succeeding *A. B. MacTaggart,* who has retired

George L. Fox

from sales work to devote his full time to research and development.

George L. Fox was a sales representative for the company in Michigan and just before his appointment as sales manager was sales representative in the Ohio territory.

HIGH SPEED FREIGHT DEMANDS

emphasize the need for modern power

Today's freight demands can only be met through a maximum of operating efficiency . . . operating efficiency that is backed up by MODERN Motive Power, capable of hauling increased loads at higher speeds. Reduced running time means increased availability . . . and increased availability means increased revenues. Lima-built Modern Steam Locomotives have shown what Modern Steam Power can do to decrease running time and increase availability and freight revenues.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**

AMERICAN CAR AND FOUNDRY COMPANY.—*Justus W. Lehr,* district manager in charge of Berwick, Pa., plant of the American Car and Foundry Company, to succeed *Guy C. Beishline,* resigned. *John F. Considine,* assistant district manager of the Chicago plant, has been appointed district manager of that plant.

Justus W. Lehr was at one time associated with the Pullman Company, the Mt. Vernon Car Company, the Curtis Bay Copper Iron Works of Baltimore, Md., and the Sanford Day Iron Works, Knoxville, Tenn. He joined American Car and Foundry in 1940 and served as assistant district manager of the Berwick plant until his transfer as head of the Chicago plant in December, 1944.

Justus W. Lehr

John F. Considine began his career in the engineering department of the Chicago passenger car shops of the Pullman Company. He joined American Car and Foundry in 1924 as an inspector at the wood mill, subsequently serving as assistant foreman in various departments until his promotion to the position of general foreman of the wood erection shop. In 1942 he was appointed superintendent of the wood car department and later general superintendent.

John F. Considine

◆

COLUMBIA STEEL COMPANY.—*J. Lester Perry,* assistant to the president of the United States Steel Corporation of Delaware, has been elected president of the Columbia Steel Company, a U. S. Steel subsidiary, to succeed the late *William A. Ross,* who died in San Francisco, Calif., on April 19. Mr. Perry was scheduled to retire May 1, but has agreed to serve as president of Columbia Steel until a permanent successor to Mr. Ross is elected.

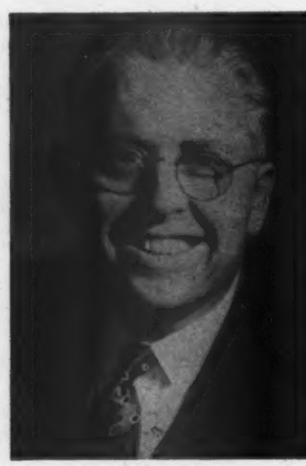
◆

MCKAY COMPANY.—*George Hohmann* has been appointed Chicago district manager of the Electrode division of the McKay Company, with headquarters in Chicago. Mr. Hohmann joined the company in 1942 to help set up additional electrode manufacturing facilities at its McKees Rocks, Pa., plant.

◆

CUMMINS ENGINE COMPANY.—*C. L. Cummins,* who founded the Cummins Engine Company in 1919, has been elected chairman of the board of directors. *J. I. Miller,* former vice-president and general manager, has been elected president of the company.

C. L. Cummins, a pioneer in the development of the high-speed Diesel engine, founded the company to build what was then called the "Cummins oil engine." The company's early years were devoted chiefly to experimentation, with only a few engine models being produced. In 1930, Cummins Engine introduced its fuel distribution and injection system. Acceptance of Cummins Diesel engines in the automotive field led to their introduction in many other applications.



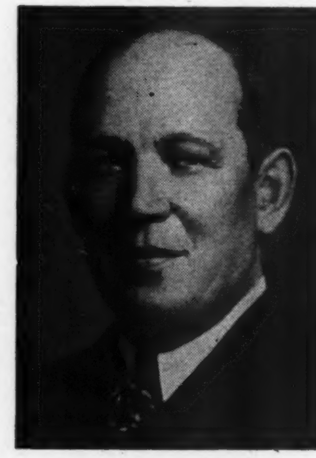
C. L. Cummins

J. I. Miller joined the Cummins Engine Company in 1934. During 1942-1944, he was an officer in the Navy. Mr. Miller is also a director of the American Zinc, Lead & Smelting Co.

◆

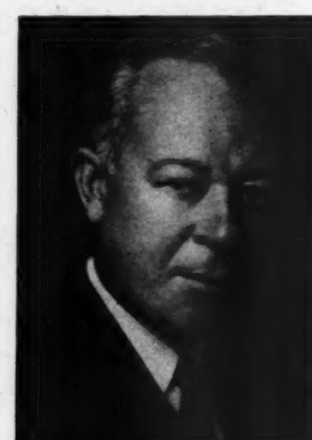
AMERICAN ARCH COMPANY.—*J. D. Brandon,* formerly vice-president in charge of sales of the American Arch Company at Chicago, has been elected president, to succeed *B. A. Clements,* who has been elected vice-chairman of the board of directors. Mr. Brandon's headquarters will be in New York.

J. D. Brandon entered railroad service in 1906 as a section hand on the Cleveland, Cincinnati, Chicago & St. Louis, advancing to general foreman at the Brightwood, Ind., shop. In 1915 he joined the American Brake Shoe & Foundry Co., as a service engineer. In 1919 he joined American Arch, as a service engineer in the Canadian territory and later transferred to the Chicago area. In 1924 he became associated with the Pittsburgh Steel Company as assistant manager of sales in the Chicago district. In 1927, he returned to American Arch as assistant to the vice-president. Later in 1927, he was appointed vice-president in charge of the Chicago office and, in 1943, vice-president in charge of all sales. Mr. Brandon was elected to the board of directors early this year.



J. D. Brandon

B. A. Clements was born at Indianapolis, Ind. He was educated in the public schools of Centralia, Ill., and entered railway service in 1892 as a messenger for the Illinois Central. He soon became a clerk and advanced steadily to the position of assistant to the president of the road. In 1911 Mr. Clements became western sales manager of the Worth Brothers Steel Company; in 1918, vice-president of the Rome Mills; in 1926, president of Rome Mills, and in 1927, president of American Arch.



B. A. Clements

◆

PITTSBURGH PLATE GLASS COMPANY.—*C. John Phillips,* formerly electronic sales department manager of the Corning Glass Works' technical products division, has become associated with the Pittsburgh Plate Glass Company at Pittsburgh, Pa., as manager of product development. *Edward C.*

Hyland, director of commercial research-industrial finishes, has retired after 48 years' service with the firm.

◆

LODGE & SHIPLEY CO.—*J. Herbert Myers*, formerly secretary of the Lodge & Shipley Co., has been elected vice-president in charge of machine tool division sales. Mr. Myers also is a member of the board of directors.

◆

RAYBESTOS-MANHATTAN, INC.—*John H. Matthews*, formerly assistant general manager of the Manhattan rubber division of Raybestos-Manhattan, Inc., Passaic, N. J., has been elected vice-president in charge of that division, and *O. H. Cilley*, formerly assistant general manager of the United States asbestos division, Manheim, Pa., has been elected vice-president of that division. *A. F. Heinsohn*, general manager of the general asbestos and rubber division, North Charleston, S. C., has been elected a director of the company.

◆

CINCINNATI MILLING MACHINE COMPANY; CINCINNATI MILLING AND GRINDING MACHINES, INC.—Cincinnati Milling and Grinding Machines, Inc., sales subsidiary of The Cincinnati Milling Machine Co., has elected the following officers: *Frederick V. Geier*, president; *Walter W. Tangeman, Swan E. Bergstrom*, and *Nelson F. Caldwell*, vice-presidents. The board of directors includes Frederick V. Geier, Walter W. Tangeman, Ferris M. Angevin, Swan E. Bergstrom, Nelson F. Caldwell, and Carlos F. Roby. Mr. Bergstrom is sales manager of the Cincinnati Milling Machine Company and chairman of the National Machine Tool Builders' Association show to be held in Chicago next September. Mr. Roby has been elected also vice-president of the Cincinnati Milling Machine Company.

◆

WEATHERHEAD COMPANY.—*Gene P. Robers* has been appointed sales manager of the replacement parts division of the Weatherhead Company, with headquarters in Cleveland, Ohio. Mr. Robers also will continue as advertising and sales promotion manager.

Obituary

PAUL T. PAYNE, 67, district manager of the Dearborn Chemical Company, Indianapolis, Ind., died on Monday, April 7, at Witham Hospital in Lebanon, Ind. Forty-nine years ago Mr. Payne became associated with the Dearborn Chemical Company as a laboratory technician. Subsequently he assumed the responsibility of various positions in the sales department, starting in the Chicago office, later as Manager of the Philadelphia office, and for the past 36 years as district manager of Indianapolis office, covering the south and eastern part of the United States.

◆

EARLE GRAYDON LEONARD, manager of the Machine Tool Division of the Buffalo Forge Company, died at his home in Eggertsville, N. Y., on May 3. Mr. Leonard began in the order department of the Buffalo Forge Company in 1909 and advanced

from a clerical position to the sales department and from that department to the position of manager of the tool division. Before and during World War II he served on various committees of the National Machine Tool Builders Association.

◆

JOSEPH F. FARRELL, who retired as vice-president of the Nathan Manufacturing Company in January, 1946, died on March 31. Mr. Farrell was born in Cleveland, Ohio, where he entered the service of the Michigan Central. He left that road in 1915 as purchasing agent, to join Nathan as general sales manager. In 1917 he was elected a director of the company and, in 1923, vice-president.

◆

GEORGE A. HULL, a vice-president and director of the Union Asbestos & Rubber Co., whose death on April 5 was reported in the May issue, had been associated with that firm since 1923. Mr. Hull had served with the Great Northern for five years, and was at one time assistant mechanical

George A. Hull

engineer of the Chicago, Rock Island & Pacific. Prior to his election as a vice-president of Union Asbestos & Rubber Co., he had been general manager of the equipment specialties division of the firm. He was transferred to the Los Angeles (Calif.) area in May, 1945.

Personal Mention

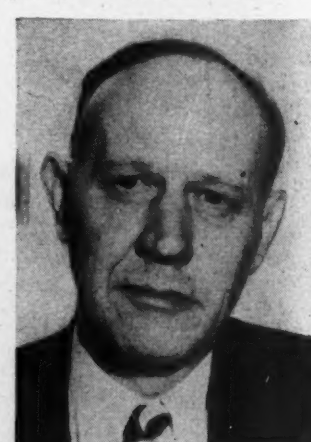
General

ALONZO G. TRUMBULL, chief mechanical engineer, Advisory Mechanical Committee, the Chesapeake & Ohio, the New York, Chicago & St. Louis, the Erie, and the Pere Marquette, retired on April 1. Mr. Trumbull was born at Hornell, N. Y., and is a graduate of Cornell University where he received his M.E. degree in 1899. He entered railroad service in 1902 as engineer of tests of the Erie. In 1903 he was appointed mechanical engineer; in 1905, assistant mechanical superintendent at Meadville, Pa.; in 1907, successively, assistant mechanical superintendent, Ohio division, and mechanical superintendent, Ohio division and Chicago & Erie; in 1912, mechanical superintendent, Erie division; in

1914, assistant to general mechanical superintendent; in 1919, assistant general mechanical superintendent; in 1920, mechanical superintendent, Ohio Region; in 1922, chief mechanical engineer, Erie Railroad at New York, and in 1929, chief mechanical engineer, Advisory Mechanical Committee, with headquarters at Cleveland, Ohio. In 1945 Mr. Trumbull was appointed also general mechanical engineer of the Chesapeake & Ohio, the Pere Marquette, and the New York, Chicago & St. Louis. Mr. Trumbull has long been active in the work of the Mechanical Division, A. A. R. In 1920 he was chairman of the Committee on Modernization of Stationary Boiler Plants and from 1925 to 1928 was chairman of the Tank Car Committee. He is a member of the American Society of Mechanical Engineers and was on the Executive Committee of the Railroad Division of that society from 1928 to 1933.

Alonzo G. Trumbull

E. R. HAUER, engineer of motive power, Advisory Mechanical Committee, the Chesapeake & Ohio, the Erie, the New York, Chicago & St. Louis, and the Pere Marquette, at Cleveland, Ohio, has been appointed chief mechanical engineer of the committee. Mr. Hauer was born at Springfield, Ohio, on January 14, 1893. He received his education at the Virginia Mechanics Institute and became an employee in the smith shop of the C. & O. at Clifton Forge, Va., on November 22, 1907. He served in the boiler shop in 1908; as a



E. R. Hauer

Iron Hand

in Velvet Glove

Today's fast schedules bring multiplied forces that must be ruled with an iron hand.

Westinghouse HSC electro-pneumatic brake equipment provides this iron hand . . . but "gentles" it with a velvet glove. The braking impulse is transmitted to all cars in the twinkling of an eye. Braking forces are equalized on each car. Pressures are automatically proportioned to various ranges of speed. And braking forces on individual wheels are automatically softened, if poor rail conditions induce an incipient slide.

Any consideration of faster schedules should *start* with consideration of modern brakes. Westinghouse "HSC" Electro-Pneumatic Brake can speed up schedules without extending top speeds.

Brakes are Basic to Railroad Progress

Westinghouse Air Brake Co.

WILMERDING, PA.

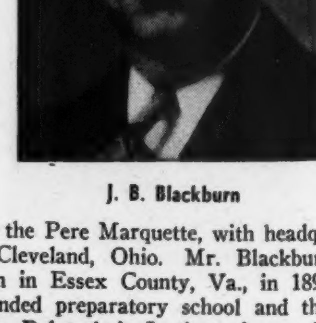
clerk in 1911, and in 1912 became a machinist apprentice at Clifton Forge. In 1916 he went to Richmond, Va., as mechanical draftsman, and in 1917 was appointed valuation inspector. In 1918 he entered the service of the U. S. Army and in 1920 became elevation engineer for the Lima Locomotive Works. He returned to the C. & O. in 1922 as enginehouse foreman at Lexington, Ky. Later in 1922 he was appointed chief draftsman at Richmond. He became assistant shop superintendent at Huntington, W. Va., in 1929; mechanical engineer at Richmond in 1932, and from 1936 until April, 1942, was engineer of motive power, Advisory Mechanical Committee of the C. & O., the Erie, the Nickel Plate, and the Pere Marquette. From April, 1942, until July, 1944, he was assistant and associate director, Office of Defense Transportation. He then resumed his duties as engineer of motive power, Advisory Mechanical Committee, at Cleveland.

P. H. Smith, assistant to engineer of tests of the Chicago, Burlington & Quincy at Aurora, Ill., has been appointed engineer of tests, with headquarters at Aurora.

H. J. Stein, electrical engineer of the Atlantic Coast Line, has been appointed mechanical engineer, with headquarters at Wilmington, N. C.

H. G. Moore, assistant superintendent car department of the Atlantic Coast Line at Wilmington, N. C., has been appointed assistant chief of equipment, with headquarters at Wilmington.

Joseph Brodnax Blackburn, mechanical engineer of the Chesapeake & Ohio at Richmond, Va., has been appointed engineer of motive power, Advisory Mechanical Committee of the Chesapeake & Ohio, the New York, Chicago & St. Louis, the Erie,



J. B. Blackburn

and the Pere Marquette, with headquarters at Cleveland, Ohio. Mr. Blackburn was born in Essex County, Va., in 1898. He attended preparatory school and the Virginia Polytechnic Institute from which he received his B.S. in mechanical engineering in 1921. From 1921 until 1924 he was a teacher in Junior High School at Norfolk, Va. On May 1, 1924, he became a draftsman in the employ of the C. & O. at Richmond. On February 1, 1929, he be-

came special mechanical inspector at Richmond; on March 1, 1929, chief draftsman; on February 1, 1930, mechanical engineer; on January 1, 1932, draftsman; on August 1, 1933, mechanical inspector, and on December 1, 1934, equipment inspector at Huntington, W. Va. On February 1, 1936, Mr. Blackburn was appointed engineer motive power, Advisory Mechanical Committee, at Cleveland; on August 1, 1936, mechanical assistant to chief mechanical officer of the C. & O., and on November 1, 1938, mechanical engineer at Richmond. Mr. Blackburn is a member of the Locomotive Construction Committee of the Mechanical Division, A. A. R.

C. H. Whistler, Jr., master mechanic of the Pennsylvania at Harrisburg, Pa., has been appointed superintendent of motive power, Eastern Ohio division, with headquarters at Pittsburgh, Pa.

H. C. Wright, superintendent of motive power, Eastern Ohio division of the Pennsylvania, has been appointed superintendent of motive power, Western Pennsylvania division, with headquarters at Pittsburgh, Pa.

B. M. Swope, superintendent of motive power, Western Pennsylvania division of the Pennsylvania, at Pittsburgh, Pa., has been appointed assistant to the general superintendent of motive power, with headquarters at Pittsburgh.

J. C. Parker has been appointed assistant superintendent car department of the Atlantic Coast Line at Wilmington, N. C.

F. C. Wenk, road foreman of engines of the Atlantic Coast Line at Tampa, Fla., has been appointed superintendent air brakes, with headquarters at Wilmington, N. C.

Wilfred C. Bowra, whose appointment as general superintendent of motive power and car equipment of the Grand Trunk Western, at Battle Creek, Mich., was reported in the May issue, was born on October 8, 1910, at Stratford, Ont. He entered the employ of Canadian National in 1928, serving as a machinist apprentice successively at Stratford and at Toronto, Ont. He was later mechanical inspector of Central Region, at Toronto, and locomotive foreman at Cochrane, Ont., Toronto and

Wilfred C. Bowra

Montreal, Que. In June, 1943, he was appointed assistant superintendent of motive power and car equipment of the Montreal district, and in November, 1943, superintendent of motive power and car equipment.

Jose G. Pulido, superintendent of machinery and equipment of the Mexican Railway at Alpizaco, Mex., has retired after 30 years of service.

S. B. Dyer, assistant engineer of tests of the Boston & Maine and the Maine Central, has been appointed engineer of tests, with headquarters at Billerica, Mass.

G. G. Lynch, assistant to general superintendent motive power of the Atlantic Coast Line at Wilmington, N. C., has been appointed assistant to chief of motive power and equipment, with headquarters at Wilmington.

P. J. Finch, locomotive draftsman for the Advisory Mechanical Committee, of the Chesapeake & Ohio, the New York, Chicago & St. Louis, the Pere Marquette, and the Erie, has been appointed mechanical engineer of the C. & O., with headquarters at Richmond, Va. Mr. Finch is 39 years old and a native of Lexington, Ky. He first became associated with the C. & O. on June 19, 1926, as a laborer in the stores department of the Huntington, W. Va., shops. Later in 1926 he was employed in the drafting room and from December, 1926, until 1928 was a machinist helper. From 1928 until 1933, while working nights as a boiler lagger, he studied mechanical engineering at Marshall College, Huntington, and from 1933 until 1f937, served as a special apprentice at Huntington, interrupting his work in 1935 to further pursue mechanical engineering studies at the University of Cincinnati. He was transferred to the Advisory Mechanical Committee at Cleveland, Ohio, as a draftsman in April, 1938. On October 29, 1943, Mr. Finch

P. J. Finch

volunteered for the United States Army and served with the 740th Railway Operating Battalion which was made up of C. & O. personnel. He entered with the rank of first lieutenant and was a captain at the time of his discharge on July 7, 1946. He then returned to the Advisory Mechanical Committee and was assigned to the committee's new equipment department

where he designed locomotives, including the C. & O's first streamline engine, No. 490. On April 1, 1947, he was appointed mechanical engineer at Richmond.

EZEQUIEL SELLEY has been appointed acting superintendent of machinery and equipment of the Mexican Railway, with headquarters at Apizaco, Mex.

C. J. OLDENBUTTEL has been appointed assistant to chief of motive power and equipment of the Atlantic Coast Line, with headquarters at Wilmington, N. C.

N. V. OLDENBUTTEL, JR. has been appointed lubrication inspector of the Atlantic Coast Line, with headquarters at Wilmington, N. C.

W. D. QUARLES, superintendent Diesel performance of the Atlantic Coast Line at Wilmington, N. C., has been appointed assistant chief of motive power, with headquarters at Wilmington.

WILLIAM JOSEPH CRABBS, mechanical engineer of the Atlantic Coast Line at Wilmington, Del., has been appointed assistant chief of motive power and equipment, with headquarters at Wilmington. Mr. Crabbs was born at Hagerstown, Md., on September 5, 1912, and received his B. S. in mechanical engineering from Virginia Polytechnic Institute in 1934. During the summers of 1927 to 1934 he served in the mechanical and stores department of the Western Maryland. In 1934 he became a special apprentice in the employ of the American Locomotive Company at Schenectady, N. Y. He returned to the Western Maryland in 1936 as a draftsman. In 1938 he was appointed chief draftsman and in 1940 mechanical engineer. From 1942 to October, 1945, Mr. Crabbs served as captain and major, United States Army, First Military Railway Service. On October 15, 1945, he was appointed mechanical engineer of the Atlantic Coast Line at Wilmington.

William Joseph Crabbs

Diesel

HAROLD F. MACKEY, assistant supervisor of Diesel engines of the Atchison, Topeka & Santa Fe at Los Angles, Calif., has been appointed supervisor of Diesel engines at Chicago.

V. C. GOLDEN, whose appointment as superintendent of Diesel locomotive maintenance and operation of the Chicago, Indianapolis & Louisville, with headquarters at LaFayette, Ind., was reported in the May issue, was born at Whitewater, Kan., on July 27, 1903. He received his technical training at Kansas State College and entered railroad service in November, 1922, as an electrician in the employ of the Atchison, Topeka & Santa Fe, at Newton, Kan. He was subsequently a machinist and automatic train-control maintainer until 1935 when he was appointed assistant supervisor of Diesel locomotives at Chicago. Mr. Golden was appointed electrical foreman in air-conditioning and car-lighting in May, 1938; enginehouse foreman in 1939, and Diesel shop foreman at Chicago in 1942. On February 1, 1947, he entered the service of the Chicago, Indianapolis & Louisville as special assistant to the general manager, with headquarters at LaFayette.

Master Mechanics and Road Foremen

J. G. CARLTON has been appointed assistant master mechanic of the North Florida division of the Seaboard Air Line, with headquarters at Hialeah, Fla.

P. P. COULTER has been appointed road foreman of engines, mechanical department, all divisions, of the Norfolk Southern, with headquarters at Norfolk, Va.

H. M. ALLAN, district master mechanic of the Canadian Pacific at Calgary, Alta., has retired.

R. L. HARPER, assistant master mechanic of the Seaboard Air Line at Hialeah, Fla., has been transferred to the Virginia division, with headquarters at Hamlet, N. C.

GREGOR GRANT, division master mechanic of the Canadian Pacific, at Nelson, B. C., has been appointed district master mechanic, with headquarters at Calgary, Alta.

C. N. WIGGINS, general foreman of the Louisville & Nashville, at Corbin, Ky., has been appointed to the newly created position of assistant general master mechanic, with headquarters at Louisville, Ky.

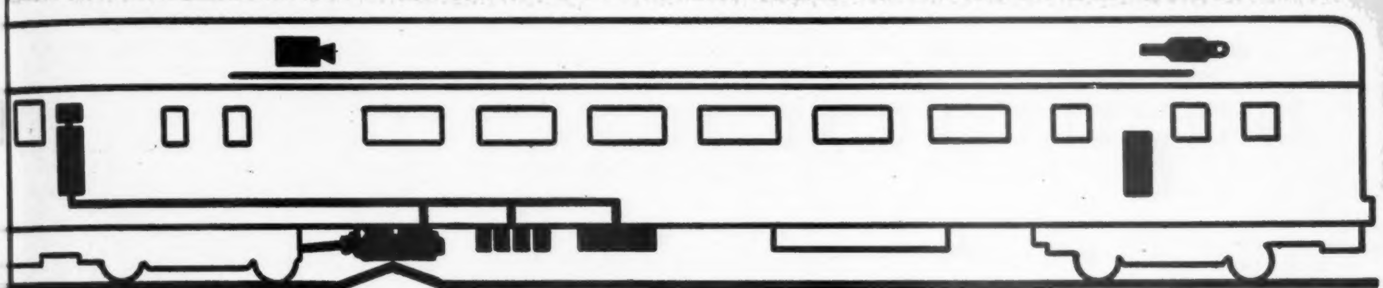
G. W. GILLELAND, master mechanic of the South Florida division of the Seaboard Air Line at Tampa, Fla., has retired from active duty, at his own request, after more than 51 years of service with that road.

D. M. WOOD, master mechanic of the Carolina and Alabama divisions of the Seaboard Air Line at Savannah, Ga., has been transferred to the South Florida division, with headquarters at Tampa, Fla.

H. E. AENCHBACHER, assistant master mechanic of the Virginia division of the Seaboard Air Line, with headquarters at Hamlet, N. C., has been appointed master

WHY YOU'LL WANT TO SPECIFY

G-E Power Supply



Data and Ratings

Motor generator, GMG-150 . . . . Form	A1	A2	A3	A4
Kilowatts	25–30	20–25	30–35	20–25
Regulated d-c volts	134	37.5	75	75
Maximum speed, regulated volts . . . . rpm	2470	3780	3780	3780
No load (85% normal volts), cut-in . . . . rpm	590	520	690	520
Full load (100% volts), cut-in . . . . rpm	780	690	915	690
Maximum output, with lead battery . . . . kw	33.5	28.5	40	29
A-c motor . . . . hp	25	25	25	25
A-c line, 220-volt, 60-cycle, 3-phase . . . . amp	63	63	63	63
D-c output, on a-c wayside power . . . . kw	15.5	15.25	15.25	15.25

A Size for Every Power Requirement

The new G-E body-mounted, axle-driven motor-generator delivers abundant power over a wide range of train speeds, insures minimum duty on storage batteries. It is sturdily constructed for dependability, long life, and reduced maintenance.

Moreover, this new motor-generator is available in four different ratings to help tailor power supply equipment more accurately to your operating conditions. From the tabulation on the left, select the ratings best suited to your passenger train operations. Then call in your G-E representative for additional information.

Shipment of these units can be made to meet production schedules.

Engineered Electrical Systems for More Passenger Comfort— More Passenger Miles

GENERAL ELECTRIC

122-4

mechanic of the Carolina and Alabama divisions, with headquarters at Savannah, Ga.

Electrical

ROBERT W. TONNING, JR., whose appointment as electrical engineer of the Atlantic Coast Line at Wilmington, N. C., was reported in the May issue, was born on January 20, 1915, at Chicago. He received his B.S. in railway electrical engineering from the University of Illinois in 1937. He entered railroad service with the Chicago, Milwaukee, St. Paul & Pacific on June 20, 1935, as extra gang foreman. On July 1, 1937, he became a special apprentice for the New York Central System at Indianapolis, Ind., then becoming electrical gang foreman at the Beech Grove shops there. From August 1 to October 5, 1942, Mr. Tonning was assistant electrical foreman of the latter shops. He then served in the Transportation Corps of the U. S. Army from October 5, 1942, to June 16, 1946. On the latter date he was appointed assistant electrical foreman of the Beech Grove shops of the New York Central, which position he held until April 15, when he went with the Atlantic Coast Line as electrical engineer at Wilmington.

Robert W. Tonning, Jr.

Car Department

GEORGE MCCREADY, general foreman of the Canadian National at Montreal, Que., has been appointed superintendent of the car shops at London, Ont.

W. G. PALMER, superintendent of the car shops of the Canadian National at London, Ont., has been appointed assistant general superintendent of car equipment, Central Region, with headquarters at Toronto, Ont.

Obituary

H. L. NEEDHAM, who retired on March 31, 1946, as master mechanic of the Illinois Central, at Chicago, died in that city on April 16.

WILLIAM ELMER, who retired on November 1, 1935, as special engineer of the Pennsylvania at Philadelphia, Pa., died on May 6 at his winter home in Rockledge, Fla., at the age of 77.